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PAVING, SEWERAGE, WATERWORKS,
STREET LIGHTING, PARKS, STREET CLEANING,
GARBAGE DISPOSAL, PUBLIC SANITATION, BRIDGES.

SMITHSONIAN DEPOSIT

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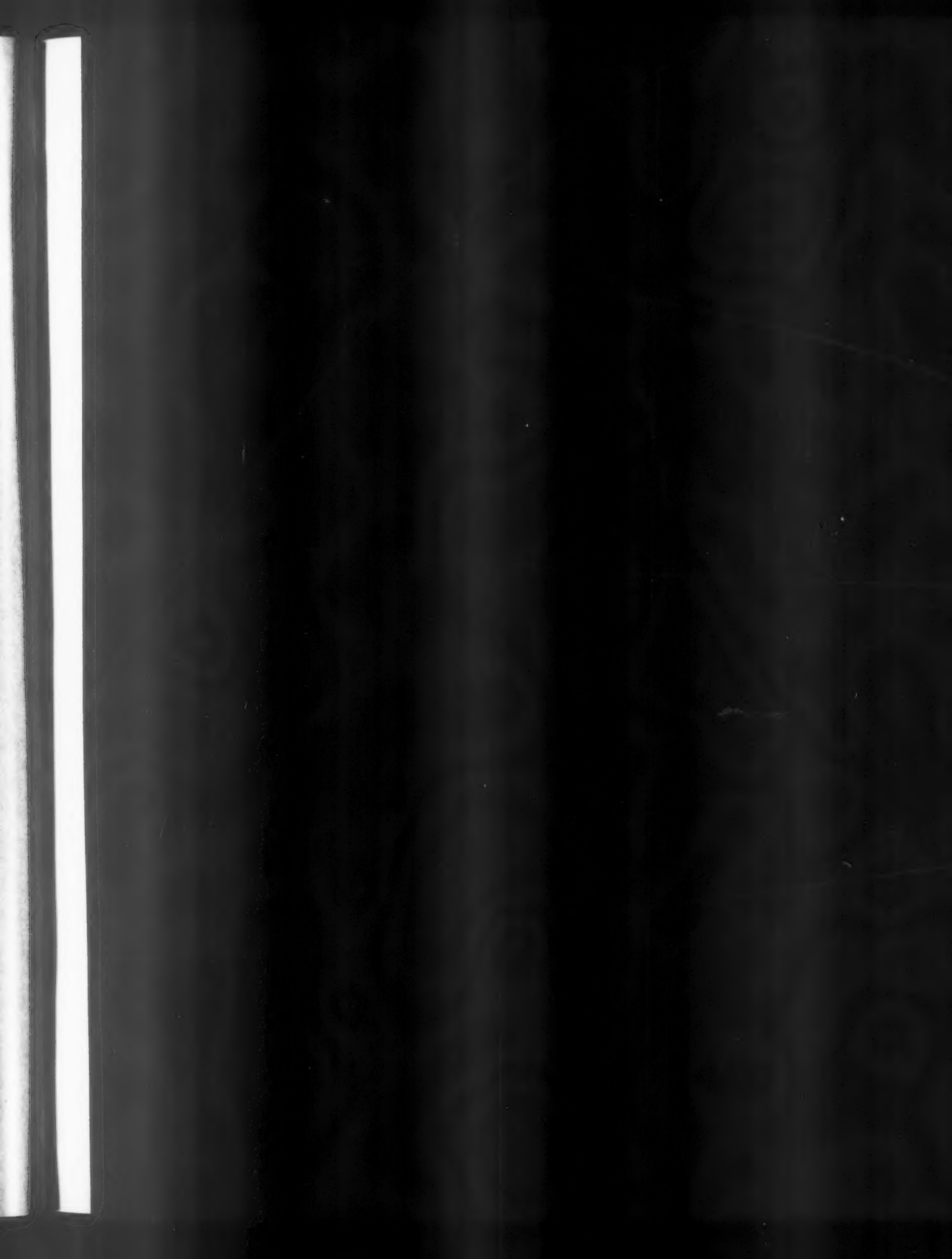


Municipal Engineering

VOLUME XXII. APRIL, NINETEEN HUNDRED TWO. NUMBER 4.

COST OF CLEANING STREETS.

The accompanying table gives some statistics of municipal taxation of all cities in the United States, ranging in population from 60,000 to 300,000 for the year 1901, and also gives data regarding the cost of street cleaning and sweeping. It has been prepared by Andrew Rosewater, city engineer of Omaha, Neb., from data collected by him, and will repay careful study. Both sections of the table are of interest. There is no apparent connection between population, mileage of paved streets and cost of cleaning. There are too many other factors having material influence upon the cost of cleaning to permit those named to show their effect. Very small mileage of paved streets reduces the cost of cleaning per capita, and in some cases, as might be expected, greatly increases the cost of cleaning per mile of street. The cities of large mileage have more uniform cost per mile for cleaning, all those having more than 100

Statistics of Municipal Taxation of all cities in the United States (ranging in population from 60000 to 300,000) for the year 1901

Andrew Rosewater, City Engineer, Omaha Neb.

City	Population 1900	Area Sq. M.	Assessed Valuation	Tax per $ 100 as assessed	Amount of Tax	Rate of Tax per Capita	Real Value	Rate per $100 Real Value	Real value per Capita	Annual Cost for Street Cleaning & Sweeping	Cost of Clean. & Sweep. per Capita	Miles of Paved Streets	Paved with Less than Granite	Paved with Granite or Trap Rock	Paved with Asphalt or Asphaltic Cement	City
Albany N Y	94,151	10.75	$ 65,075,215	$ 1.80	$ 1,230,027	$ 13.16	$ 65,075,215	$ 1.80	$ 691	$ 42,402	$ 0.45	80.92	30	$ 524	$ 638	Albany N Y
Allegheny Pa	129,896	8.00	82,500,000	1.76	1,448,560	11.15	91,700,000	1.58	705	45,000	0.35	84.06	30	535	802	Allegheny Pa
Atlanta Ga	89,872	11.00	53,117,717	1.45	771,076	8.58	73,613,786	1.05	819	——	——	63.00	—	—	—	Atlanta Ga
Bridgeport Conn	70,996	13.40	62,906,222	1.30	817,781	11.52	62,906,222	1.30	886	23,917	0.34	4.75	18	5835	5962	Bridgeport Conn
Cambridge Mass	91,886	6.00	56,216,875	1.75	1,682,931	18.32	56,216,875	1.75	1047	30,000	0.33	6.00	48	5000	5625	Cambridge Mass
Camden N J	75,935	9.25	28,654,210	2.65	760,414	10.01	43,415,470	1.75	572	25,000	0.33	46.00	25	510	918	Camden N J
Columbus O	125,560	16.25	66,847,580	2.47	1,653,928	13.17	133,695,160	1.065	1.24	55,000	0.44	117.41	30	469	704	Columbus O
Dayton O	85,333	10.75	45,364,300	2.68	1,215,743	14.25	100,000,000	1.172	1.21	19,685	0.23	51.17	-	431		Dayton O
Denver Colo	133,859	54.00	134,364,115	0.81	1,314,237	9.82	134,364,115	1.004	1.86	40,000	0.29	24.00		1538		Denver Colo
Des Moines Ia	62,139	56.00	13,871,430	4.02	683,711	11.00	55,485,720	1.23	1.23	14,548	0.24	61.00		238		Des Moines Ia
Detroit Mich	285,704	28.00	247,248,500	1.57	3,777,425	13.23	308,060,625	1.082	1.48	128,760	0.45	298.00	28	432	694	Detroit Mich
Fall River Mass	104,863	41.00	74,554,380	1.88	1,412,588	13.47	74,554,380	711	1.88	32,000	0.29	76.00	35	857	1102	Fall River Mass
Grand Rapids Mich	87,565	17.00	61,000,000	1.65	1,004,954	11.48	101,666,667	1161	0.98	42,000	0.48	144.00	65	282	282	Grand Rapids Mich
Hartford Conn	79,850	17.00	69,760,630	2.21	1,543,087	19.32	69,760,630	875	2.21	62,823	0.78	85.13		710		Hartford Conn
Indianapolis Ind	169,164	28.14	129,184,950	1.95	2,518,106	14.88	183,777,425	1.45	1.30	47,000	0.28	84.00	50	547	492	Indianapolis Ind
Jersey City N J	206,433	16.28	95,602,562	2.80	2,678,872	12.98	136,575,088	668	1.96	71,000	0.34	130.00	35	546	702	Jersey City N J
Kansas City Mo	163,752	26.30	80,000,000	2.45	1,960,000	11.97	200,000,000	1221	0.98	82,000	0.50	180.00	32	455	448	Kansas City Mo
Lawrence Mass	62,559	7.25	38,841,687	1.59	634,214	10.14	53,122,243	849	1.19			2.75	65			Lawrence Mass
Los Angeles Cal	102,479	43.20	67,598,920	1.47	993,719	9.68	67,598,920	661	1.47	88223	0.86	24.50				Los Angeles Cal
Louisville Ky	204,731	20.50	127,000,000	2.03	2,580,612	12.60	211,666,666	1034	1.22	109,000	0.53	167.00	36	653	816	Louisville Ky
Lowell Mass	94,969	12.40	71,674,588	1.93	1,383,265	14.57	71,674,588	755	1.93	28,000	0.29	18.25	35	1534	1972	Lowell Mass
Lynn Mass	68,513	11.33	52,168,015	1.90	992,536	14.49	61,374,135	896	1.61	5,000	0.07	4.00	34	1250	1654	Lynn Mass
Memphis Tenn	102,320	16.00	43,000,000	2.17	934,655	9.13	71,666,667	700	1.30	20,000	0.20	85.00	65	235	143	Memphis Tenn
Milwaukee Wis	285,315	23.00	158,174,873	2.22	3,506,172	12.29	263,624,788	924	1.33	106,580	0.37	110.80		962		Milwaukee Wis
Minneapolis Minn	202,718	53.50	102,212,506	2.37	2,419,806	11.44	170,354,410	840	1.42	41,515	0.20	105.11	27	403	672	Minneapolis Minn
Nashville Tenn	80,865	9.50	38,485,860	1.95	750,258	9.28	51,314,453	635	1.46	32,700	0.40	59.8	32	5685	7735	Nashville Tenn
Newark N J	246,070	18.50	157,320,684	2.11	3,426,465	13.92	224,743,834	905	1.52	85,000	0.35	119.00	36	714	892	Newark N J
New Bedford Mass	62,442	19.75	62,856,040	1.76	1,094,391	17.53	62,856,040	1007	1.76	16,927	0.26	20.00	27	746	1243	New Bedford Mass
New Haven Conn	108,027	22.00	99,000,000	1.66	1,623,594	15.03	99,000,000	916	1.64	43,250	0.40	46.97		921		New Haven Conn
New Orleans La	287,104	196.25	139,230,286	2.20	3,063,066	10.67	174,037,860	606	1.76	120,303	0.42	205.76	40	584	657	New Orleans La
Oakland Cal	66,960	18.80	46,720,766	2.16	966,105	14.44	67,081,149	1002	1.44	18,250	0.27	115.00	60	159	179	Oakland Cal
OMAHA NEB	102,555	24.50	36,374,184	3.40	1,236,722	12.06	90,935,465	887	1.36	22,000	0.21	85.21	45	258	258	OMAHA NEB
Paterson N J	105,171	8.36	50,000,000	2.50	1,233,319	11.73	75,000,000	713	1.67	30,000	0.28	60.00	36	500	625	Paterson N J
Portland Ore	90,426	39.50	29,554,208	3.37	995,977	11.01	88,662,627	980	1.12	38,595	0.43	214.30	56	165	206	Portland Ore
Providence R I	175,595	18.29	92,801,860	1.60	3,084,830	17.57	192,801,860	1098	1.60	60,310	0.34	31.89	30	1891	2836	Providence R I
Reading Pa	78,061	6.25	49,982,665	1.62	716,658	9.15	83,569,783	1070	0.86	15,000	0.19	12.00	42	1250	1939	Reading Pa
Richmond Va	85,050	5.00	69,552,921	1.40	973,938	11.45	84,069,428	988	1.16	60,006	0.71	28.00	42	2143	2296	Richmond Va
Rochester N Y	162,608	18.18	115,569,790	1.55	1,793,000	11.03	164,442,358	888	1.09	58,365	0.36	125.00	27	467	778	Rochester N Y
Scranton Pa	102,026	21.00	23,354,046	3.12	728,646	7.14	66,725,846	656	1.09	12,629	0.12	20.25		623		Scranton Pa
Somerville Mass	61,643	4.22	53,799,200	1.69	907,660	14.72	53,799,200	873	1.69	9,500	0.15	3.50	40	2657	2988	Somerville Mass
Springfield Mass	62,059	38.53	72,358,481	1.49	1,077,375	17.36	72,358,481	1166	1.49	24,912	0.40	45.90	36	543	679	Springfield Mass
St Joseph Mo	102,979	55.00	24,000,000	2.87	689,992	6.70	48,000,000	466	1.44	12,000	0.12	25.00	40	480	560	St Joseph Mo
Seattle Wash	80,671	30.00	60,168,265	1.35	542,001	6.72	66,913,735	822	0.81	10,076	0.12	14.4		912		Seattle Wash
St Paul Minn	163,065	55.00	90,000,000	2.65	2,385,000	14.63	138,461,538	849	1.72	70,000	0.43	46.00	36	1522	1902	St Paul Minn
Syracuse N Y	108,374	16.00	87,103,153	2.13	1,855,265	17.12	87,103,153	804	2.13	29,383	0.73	37.24		2132		Syracuse N Y
Toledo O	131,822	28.57	64,051,410	2.47	1,582,076	12.00	106,752,350	810	1.48	45,405	0.34	139.70	26	325	562	Toledo O
Troy N Y	60,651	9.10	53,913,814	1.40	754,262	12.44	53,913,814	889	1.40	105,000	1.73	37.26	25	282	508	Troy N Y
Trenton N J	73,307	7.26	35,448,521	2.22	741,255	10.11	54,355,831	741	1.36	12,000	0.16	20.00	36	600	750	Trenton N J
Washington D C	278,718	69.25	198,488,413	1.52	3,014,360	10.82	300,760,020	1079	1.00	161,000	0.58	266.00	35	605	778	Washington D C *
Wilmington Del	76,508	10.18	40,000,000	2.10	840,000	10.98	60,000,000	784	1.40	15,000	0.20	56.00	25	278	500	Wilmington Del
Worcester Mass	118,421	36.90	114,278,135	1.52	1,741,602	14.71	114,278,135	965	1.52	32,000	0.27	12.00	30	1667	3800	Worcester Mass
Total	6,251,760				77,741,779	$ 12.49	$ 5,174,925,832	4971	$ 1.25	$ 2,344,857	$ 0.66					Total
Average	128,535				1,524,348	12.46	119,318,271	892	1.39	45,977	0.37					Average

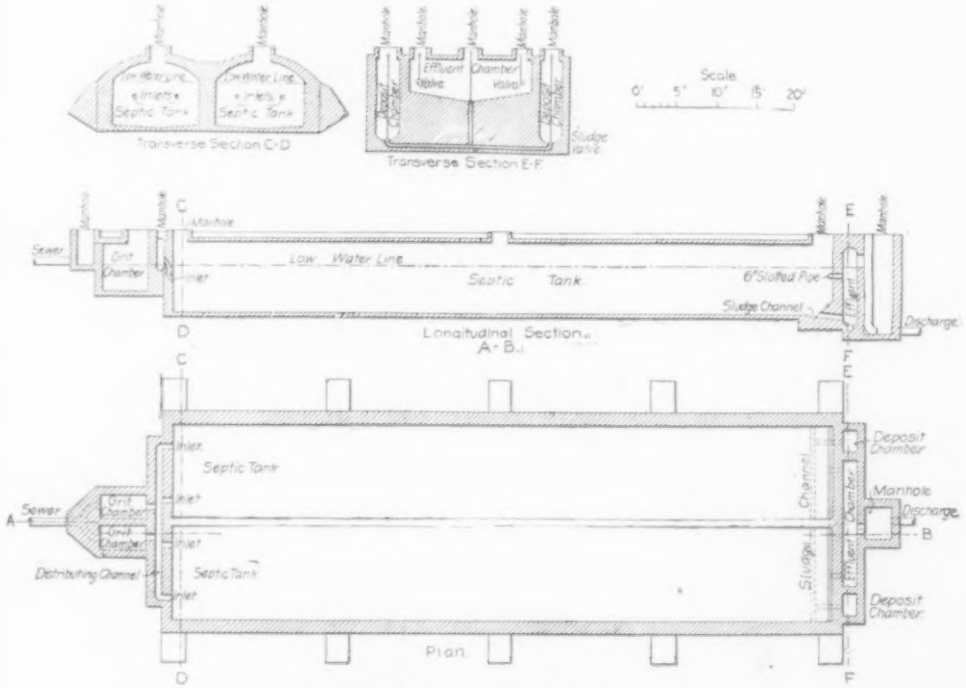
* Washington D.C. is taxed for one half of expenses, minus receipts from liquor and other licenses and from corporation annuities — the U.S. Government paying one half of all expenses, the appropriation being $ 4,99,540.

NOTE — Where the per capita valuation of cities varies $ 1.00 or more above or below the average of $892 there is clearly some discrepancy in the enumerated population or in the reported ratio of real to assessed value. This includes municipal and school but not County and State taxes.

miles of paved streets, excepting four, paying from $640 to $892 a mile for cleaning streets, and one of the four pays $562. Likewise all but two pay between 34 and 53 cents per capita for cleaning streets. Increase in extent of paving operates on the one hand to reduce the cost of cleaning per yard of area by reducing the amount of dust and mud carried in from unpaved streets, and on the other hand to increase the cost per year by educating the people up to requiring cleaner streets, to be obtained only by more frequent sweepings. The conditions as to paving have been too unequal in the past to give the question of cleaning any uniformity of answer, and this table demonstrates the fact. A similar table prepared for 1911 for the same cities will show material improvement.

THE SEPTIC TANKS AT VANCOUVER, B. C.

The city of Vancouver, British Columbia, is situated on the south shore of Burrard Inlet and the east shore of English Bay and is almost divided into two portions by a small arm of the sea known as False creek, which extends from the bay parallel with Burrard Inlet to within half a mile of the eastern limits of the city.



SEPTIC TANKS, VANCOUVER, B. C.

Prior to 1899 one sewer discharged into English Bay and there were four sewer outlets into Burrard Inlet, but no sewerage was provided for that portion of the city which would naturally drain into False creek, a great portion of which was tide flats. In order to sewer that portion it was necessary to provide some means of treating the sewage before discharging it into the salt water to prevent it becoming offensive and depositing any sewage matter on the tide flats.

Various forms of bacterial filters were suggested, also septic tanks with or without filters, and in March, 1899, Mr. James F. Garden, C. E., mayor, and the city engineer were deputed to go and examine the tank in operation at Champaign, Ill., designed by Prof. A. N. Talbot of the State University of Illinois.

The result was so satisfactory that on their return they recommended the council

PUBLIC BATH HOUSE, ROCHESTER, N. Y.

to adopt the system where sewage was to be discharged into salt water with current not sufficient to carry it entirely away.

Plans were obtained from Prof. Talbot, but the Septic Tank Syndicate having obtained letters patent in Canada threatened, through their agent, to institute legal proceedings if the city adopted the system without paying them. The city solicitor finally advised the city, in order to avoid litigation, to accept the terms of the syndicate to supply plans and necessary iron-work fittings for the sum of $1,500 for three tanks of capacities of 2,000, 3,000 and 5,000 inhabitants, respectively.

The tanks were built of concrete, arched over with the same material, and were put into use about the beginning of 1901. The accompanying drawings show the general features of the design of the tank designed to serve 2,000 people. The chambers are each 84 feet by 12, and 6 feet deep. For 3,000 population each of the two chambers is 92 feet by 14 feet, and 7 feet deep. For 5,000 population, three chambers are provided, each 102 feet by 14 feet, and 7 feet deep. These dimensions allow for about 6 cubic feet per inhabitant, or about 18 hours' sewage. The drawings show the tanks as constructed according to the plans of the syndicate. They might be simplified somewhat, with advantage.

Some slight changes were made from the plans furnished by the syndicate so as to do away with any woodwork in the construction, the influent and outlet channels being arched over and all the manholes (iron) carried up to the surface. The surface was covered with earth levelled and seeded and is not in the least unsightly, only the manhole-covers showing at the surface to distinguish it from an ordinary lawn.

After being in use a short time a slight scum formed on the surface which increased during the warm weather, the purification of the sewage becoming more decided as the growth of the scum, in which the bacterial action is principally carried on, progressed.

The best results so far appear to be attained with the largest tank near the crematory, into which five or six loads of night-soil a week are dumped, the scum on the surface of this tank being much thicker and the effluent clearer than from the others in which the sewage is more dilute.

From our experience thus far we are satisfied that septic tanks are sufficient in most cases for sewage purification, where the discharge is into salt water or streams which are not used for water supply, and where necessary to use filters to obtain more thorough purification, they increase the capacity of the filters by destroying the greater part of the solid matter of the sewage.

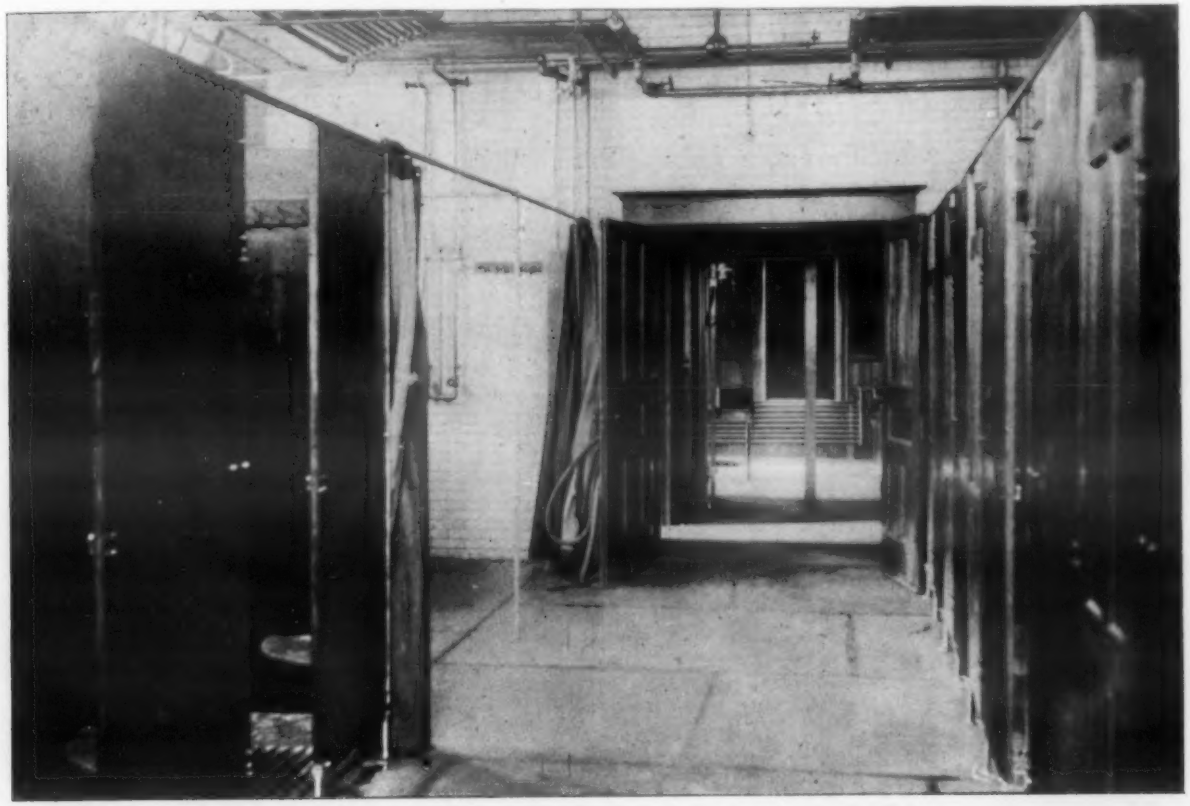
Mr. Thomas H. Tracy, city engineer of Vancouver, has very kindly supplied the information in this article, and the drawings from which our illustration is made.

PUBLIC BATHS IN ROCHESTER, N. Y.

The following report on the public bath house in Rochester, N. Y., taken from the last annual report of the department of public works, will be of much interest to the many cities now considering this question, as it is a description of an economical installation which has done good service. It will doubtless develop a need for additional facilities, either entirely free or subject to small fees according to the system in some other places. In an early number we will have a full description of a more elaborate plant operated under small fees with occasional free days that a comparison of the two plans may be made. The illustrations show the exterior of the old building and the new bath-room addition, a plan of the main floor of the entire building, and a view down the corridor between the bath-rooms, looking toward the office or waiting-room.

Property on South avenue, owned by the Home of Industry, was purchased for the sum of $10,000. The old building on this property not being suitable for a bath house proper, it was fitted up for a waiting room and living rooms for the attendants, and an annex constructed to contain the baths. The cost of this work was about $5,000, making a total cost of $15,000. The building was opened to the public on July 27, 1899.

The building is 25x61 feet; the front portion, 25x32 feet, being the old building, is two stories in height, and in the second story are the living rooms of the attendants. Two rooms have also been fitted up in the attic for sleeping rooms. The first floor of the old building is occupied by a waiting room 18x19 feet, and by a wash room 8x11 feet, containing a wash tray and drying apartment heated by steam. There are also



INTERIOR OF PUBLIC BATH HOUSE, ROCHESTER, N. Y.

two water closets in this portion of the building.

The new portion, 25x39 feet, is occupied entirely by shower-baths. There are in this portion thirteen rooms, 4 ft. 6 in. x 8 ft., equipped with shower baths, in addition to which there is a larger double shower, 8x14 feet, for boys. This latter room has been divided into two rooms, 8x7 feet, making altogether fifteen separate rooms.

This building stands on a lot having a frontage on South avenue of 52.5 feet, and a depth of about 200 feet. There is also quite a large plot of land in the rear of this lot, making the area all together about a half acre.

The baths have been well patronized from their opening, as will be seen by the following statements:

From the time the building was opened, on July 27, 1899, to January 1, 1900, the total number of baths taken was 19,089. For the year 1900 the total number of baths taken was 53,172, or an average of about 170 per day for the entire year. A comparison of the number using the baths in the different months, and also the number using them during the year 1900, as compared with the same period in 1899, may also be of interest. The average for one week in July and for the month of August was 199 per day; September, 152 per day; October, 165 per day; November, 129 per day; December, 112 per day.

In 1900 the average in the month of January was 109 per day; February, 104; March, 108; April, 129; May, 182; June, 287; July, 252; August, 296; September, 167; October, 155; November, 111; December, 120.

The bath house is open for six days in the week, fourteen hours per day. Tuesday and Friday afternoons are set apart for women. During the year 1900, of the 53,172 baths taken, the attendants report 8,677 baths taken by women, being about 16 per cent. of the whole.

The largest number of persons using the bath on any day since it was opened was on August 13, 1900, when 879 baths were taken. The itemized cost of maintenance for 1900 was as follows:

Lighting	$ 206 69
Laundry	335 00
Coal, 116 tons	450 00
Soap, 1,977 pounds (6½cents, less 606 pounds returned at 3 cents per pound)	109 32
Miscellaneous supplies	98 15
Repairs	305 41
Alterations to provide additional room for the attendants	175 50
Insurance	37 72
Attendants	1,300 00
Total	$3,017 79

The annual cost of maintenance, exclusive of extraordinary repairs or alterations, is about $2,700.

PUBLIC WORKS ADMINISTRATION.

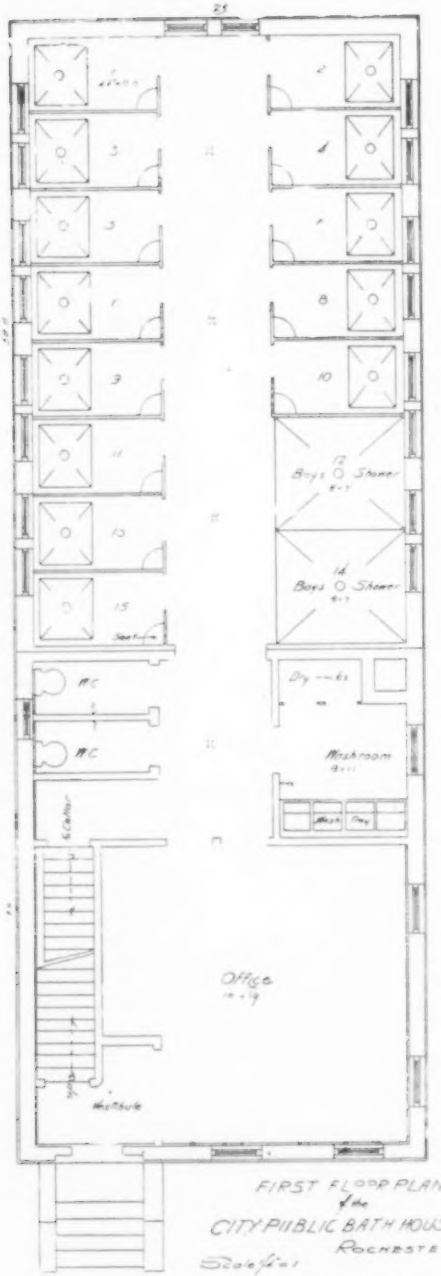
By John A. Fairlie, University of Michigan, Ann Arbor, Mich.

Public works administration in the cities of the United States presents the most confusing variety of methods. For particular branches of work there are boards and single commissioners, often both systems existing in the same city. These officers are most frequently appointed by the mayor with the consent of the city council; but there are many exceptional cases where appointments are made sometimes by the mayor alone, sometimes by the governor of the state, occasionally by judges, and in some cities some officials are chosen directly by popular vote. In many cities there is some attempt made to co-ordinate and organize the work of several of the most closely related branches of public improvements, but it is seldom that this organization is complete, and in many cases each branch of work is conducted independently of all the others.

It may be of service to note the leading features of public works administration in some of the leading cities. This showing will at least emphasize the existing confusion. It should demonstrate the need for a more systematic management. And it may suggest some definite scheme of organization.

Under the New York charter of 1897 there was provided a board of public improvements consisting of a president, six commissioners for various public works' departments, and, as ex officio members, the mayor, corporation counsel, the comptroller, and the presidents of the five boroughs. The president of the board and the six department commissioners were each appointed by the mayor, as was also the corporation counsel; while the mayor, comptroller, and borough presidents were chosen by popular vote. The board controlled the general plan for public works, while the execution of these plans and the maintenance of ex-

PLAN OF PUBLIC BATH HOUSE, ROCHESTER, N. Y.



FIRST FLOOR PLAN
of the
CITY PUBLIC BATH HOUSE
ROCHESTER NY

Scale 1/8" = 1'

Traced May 1961 from the original tracings
belonging to FOSTER KELLEY Architect
by [illegible]

Sheet No 2

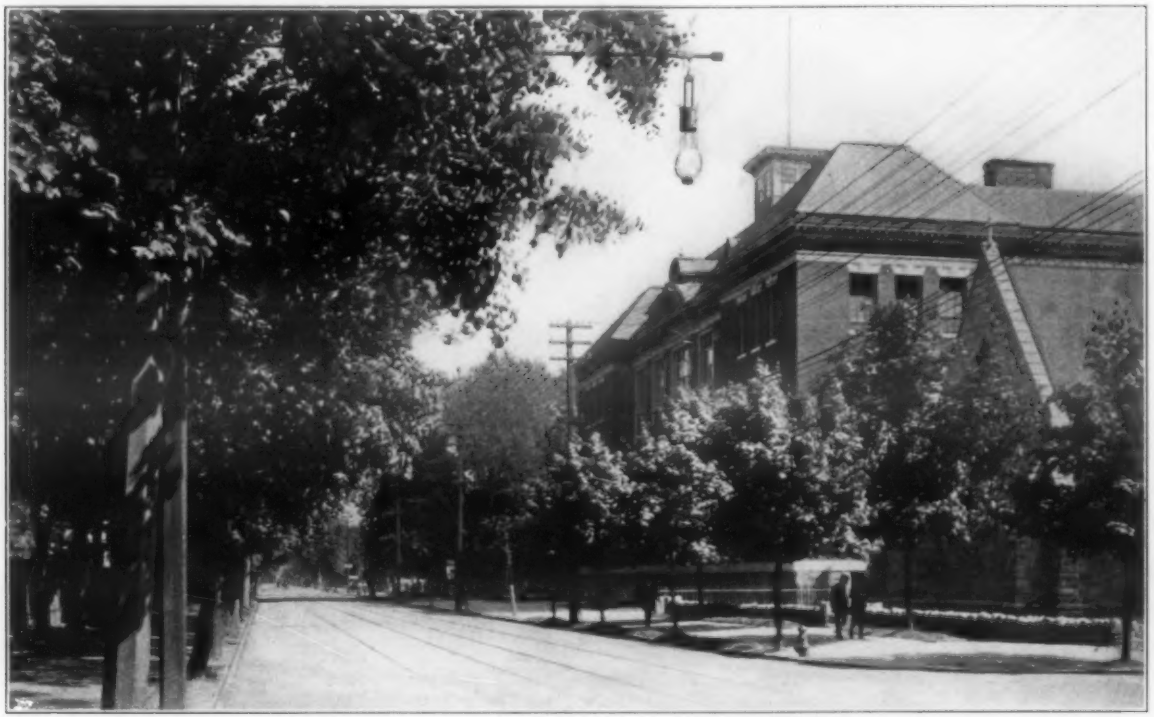
isting work was under the management of the different commissioners for water supply, for highways, for street cleaning, for sewers, for bridges, and for public buildings, lighting and supplies. Entirely independent of these departments and the board of public improvements were a number of other departments engaged in municipal works. The parks were placed under the control of three commissioners, each having jurisdiction of the parks in one section of the city; the docks and ferries were placed under a board of three members, and the construction of the new East river bridge was placed in charge of a special board—all of these officials being appointed by the mayor. In addition, the construction of new water supply works and the rapid transit subway were under permanent boards appointed by state authority.

The amended charter which went into effect in 1902 makes some important changes in this system. The board of public improvements has been abolished, and its powers assigned partly to the board of estimate and apportionment, partly to the various officers charged with special departments. The five elected borough presidents are given control over the highways, sewers and public buildings in their respective boroughs, and they have established and appointed in each borough a commissioner of public works, subordinate to whom are a superintendent of highways, a superintendent of sewers, a superintendent of public buildings and a superintendent of incumbrances, while in the borough of Manhattan there will also be a superintendent of baths. The commissioners of street cleaning and bridges remain as before, with jurisdiction over the entire city, the latter absorbing the powers of the new East river bridge commission, and the commissioner of water supply has added to his department the supervision of gas and electric companies. The three park commissioners have been formed into a board with powers of general regulation, but each commissioner is still assigned to a definite section of the city for his special control. A single dock commissioner has been substituted for the dock and ferry board. All of these officials, except those subordinate to the borough presidents, are appointed by the mayor, and all are salaried officers. The permanent state aqueduct and rapid transit boards continue in existence.

Chicago has had since 1861 an organization of the co-ordinate services of water supply, sewers, parks, streets, river and harbor and public buildings, at first under an elected board, changed in 1867 to an appointive board, and in 1876 changed again to a single commissioner of public works appointed by the mayor. As now organized there are six bureaus in the department, the heads of which are appointed by the commissioner of public works. The city engineer has charge of bridges and viaducts, the harbor improvements, and the water-works; the superintendent of streets attends to paving and scavenging; the water bureau to the collection of revenue for the use of water; and the remaining bureaus to the sewerage system, special assessments, maps and plats, and track elevation. But independent of the department of public works, and indeed independent of the city corporation are the board of trustees for the sanitary district, elected by popular vote, and the three park boards, two appointed by the governor of the state, and one by the judges of the circuit court.

Philadelphia has organized most of the municipal public works into a single department. At the head of this department is the director of public works, appointed by the mayor subject to confirmation by the select council, who receives a salary of $10,000 a year, and holds office for four years, or until his successor is appointed, unless removed for cause. Within this department there are seven bureaus: Highways, lighting, street cleaning, surveys, water, gas and city ice boats. The chiefs of these bureaus, with one exception, are appointed by the director of public works, subject to confirmation by the select council. The chief inspector of gas meters, however, is appointed by the mayor. The salaries of these bureau chiefs vary widely. The highest is the chief engineer of surveys, who receives $8,000 a year; the chief of the water bureau, $6,000; the chief inspector of gas meters has $5,000; the chief of the highways bureau, $4,000; the chief of the street cleaning bureau, $2,500; the chief of the bureau of lighting, $2,000, and the superintendent of the city ice boats, $1,650. Each bureau is managed directly by its own chief, under the supervision of the director of public works. But there is provided a board of highway supervisors, composed of the bureau chiefs concerned in works which cause breaks in the street surface, to systematize that work so as to prevent unnecessary openings and reduce expenses.

There are, however, two other administrative bureaus engaged in public works which are very largely independent of the department and officials just mentioned,



DELAWARE AVENUE AND HIGH SCHOOL, WILMINGTON, DEL.

One of these is the park board, composed of ten unpaid members appointed by the judges of the court of common pleas, and six ex-officio members, as follows: The mayor, the presidents of the select and common councils, and the chiefs of the water bureau, the survey bureau, and the bureau of city property. The other is the harbor board, composed of the chief of the bureau of surveys and six members appointed by the presidents of the select and common councils.

In Boston the public works of the city are to a large extent organized under a single department: but there are some independent bureaus, while the various boards for the works of interest to the larger metropolitan community increase the element of disorganization. The city superintendent of streets has control over paving, bridges, ferries, street cleaning and sewers, with subordinate bureaus for each class of work. But the water commissioner is an independent official, as are also the board of street openings, the park board and the rapid transit board, which has charge of the construction of subways and tunnels. The last named board is, moreover, appointed by the state governor. For the more extensive metropolitan works, there have been three boards, each appointed by the governor; in 1901 the water and sewerage boards were consolidated, but the metropolitan park board is still an entirely separate authority.

Baltimore has a board of public improvements, with general control over all public works except the parks, which are under the control of a board of five unsalaried members. The board of public improvements is composed of the city engineer, the inspector of buildings, and the presidents of the water and harbor boards, who are all salaried officials. In addition to their salaried presidents the water and harbor boards have each four unpaid members.

All of the branches of municipal public works in St. Louis have been organized into a definite system, although on somewhat different lines from the partial organization in Philadelphia. There is here a board of public improvements, consisting of a president elected by popular vote, and five commissioners appointed by the mayor, each of whom is assigned to a special division corresponding to the bureaus in the Philadelphia organization. Thus there is a street commissioner, controlling the construction, repair, and cleaning of streets, a sewer commissioner, a water commissioner, a harbor and wharf commissioner, and a park commissioner. Provision is also made for a gas commissioner, if the city should at any time own and operate municipal gas works. The board prepares plans for construction works for submission to the municipal assembly, and enters into contracts for the works to be undertaken. The president presides at the meetings of the board, and has supervision over the various commissioners. He receives a salary of $5,000 a year. The salaries of the commissioners range from $4,500 to $3,000 each.

The administrative arrangements in Cincinnati also bring under one general control all the public works, except the construction of a new system of water-works. The general authority is the board of public service, composed of five members, none of whom, however, have charge of any particular services, as do the members of the St. Louis board. Under this board are the chief engineer (with divisions in this department for highways, bridges, sewers, sidewalks, and street repairs), the water-works engineer, the superintendent of parks, and the city electrician, and also two departments not often combined with public works, the health department and the city hospital. The construction of the new system of water-works is under the management of an independent board of five trustees.

Thus far, each of the cities considered stands in some important respects in a class by itself, and only the two last mentioned offer any complete organization of public works administration. But we may now turn to a considerable group of cities where there is also a complete organization on a distinctly similar plan. The group consists of Cleveland and Columbus in Ohio, and the cities of the second class in New York and Pennsylvania, Pittsburg, Allegheny, Rochester, Syracuse, Albany, Troy and Scranton. In each of these cities there is at the head of the whole field of municipal public works a single official, known in the New York cities as the commissioner of public works, and in the other cities as the director of public works. In each case, too, this official is appointed by the mayor of the city.* The jurisdiction of this officer extends in all of these cities over the streets, sewers, bridges, wharves, parks, water-works and public buildings of the city. The subordinate bureaus in this general department of public works naturally show variations of detail in the different

*In the Pennsylvania cities by the recorder, who occupies the position of mayor under recent legislation.

ELEVENTH STREET, RECENTLY OPENED, WILMINGTON, DEL.

cities, but all are characterized by the system of single officials at the head of each bureau. In the four New York cities there is a city engineer appointed by the mayor, and a superintendent of water-works and a superintendent of parks, appointed by the commissioner of public works. In Pittsburg there are eight bureaus; engineering and construction, surveys, highways and sewers, city property, water supply, water rents, public lighting and parks. In Cleveland there are four bureau chiefs, each appointed by the director, having charge respectively of the water-works, street repairs and cleaning, street and sewer construction and parks. In Columbus there are three divisions: water-works, streets, sewers and public buildings and parks.

Buffalo and Milwaukee are typical cities representing another system of administration. In each of these cities there is a salaried board of public works and a park board of unsalaried members. In Buffalo the board of public works consists of one elected and two appointed members, each receiving a salary of $5,000, under which are bureaus of engineering, water-works, streets and building. In this case the members of the board act only collectively, and the chiefs of the subordinate bureaus are selected by the board. The harbor master is independent of the board of public works, and the park board consists of the mayor and fifteen unpaid members. The Milwaukee board of public works consists of three members, each of whom has a salary of $4,000, one of whom is the city engineer. Subordinate to this board are the superintendent of bridges, the superintendent of sewers, the water-works and the harbor master. The park board has five unpaid members appointed by the mayor.

Newark and Providence have each a board of public works with powers similar to those in Buffalo, while the Providence park board and Essex county park commission control the parks of these cities.

San Francisco and Indianapolis have each similar sets of officials — a board of public works and a park board. But as the water-works in these cities are owned by private companies, the functions of the board of public works do not include that service. St. Paul has a salaried board of public works and an unpaid park board with functions similar to those authorities in San Francisco; and in addition there is a board of five water commissioners, the president of which receives a salary of $1,000 a year, and the other members $100 each.

Until the spring of 1901 the Detroit system resembled that of St. Paul, with the addition of another board for the municipal electric light plant. But in May of that year single commissioners were provided in place of two of the boards. The commissioner of public works has under his direction the streets, sewers, wharves, bridges and public buildings. The parks are also under a single salaried commissioner. The water board and lighting commission have five and six members, none of whom receive salaries. These four authorities remain entirely independent, with no organization for official co-operation.

Other cities can generally be classed with some of the systems already described, and as it would serve little purpose to take them up in detail, a few examples will indicate the methods in less important cities. Seattle resembles St. Louis, with a board of public works composed of three bureau chiefs, covering all branches. Grand Rapids has a board of public works with similar functions to those in Buffalo and Milwaukee. Reading, like St. Paul, has three boards for public works, water supply, and parks. Toledo, Worcester, and Cambridge have water and park boards, with single commissioners for other departments of public works.

Amid all this variety and confusion, it may yet be noticed that the tendency toward system and order is strongly in one direction. The only considerable group of important cities with substantially similar methods includes most of those cities which have accomplished a complete organization of the different branches of public works into a harmonious system. This is the group of New York, Pennsylvania and Ohio cities, with a system of single headed bureaus under the general control of a single director of public works appointed by the mayor of the city. The other complete systems of organization are those of St. Louis and Cincinnati, the one grouping the bureau chiefs into a general board of public improvements, the other establishing a board outside of the bureau chiefs, which takes the place of the single director. But these board systems diffuse responsibility and impose hindrances to prompt action, while the advantages of co-operative action between various bureaus can be at least as well secured through reports and recommendations to a common superior as through the consultations of bureau chiefs. It is indeed difficult to see wherein the arguments for a single head are any less strong in considering the central management of public works than they are in reference to

FARMERS' MARKET, KING STREET, WILMINGTON, DEL.

the subordinate bureaus or to the mayor as the head of the entire municipal administration.

As to the control over the particular branches of public work, the strongest objection to the universal application of the single commissioner system will come from those who believe in the unpaid boards, especially those which control the public parks. The reply must be that the management of public parks, like that of street paving or sewer construction, is essentially a technical service, that those who accept gratuitous positions can not have any adequate special training; that they are never expected to devote their whole time, even while in office, to their official duties; and that they can not be held to strict account for their performance. The execution of details must be left to subordinates, and the supervision of these details can be better secured by the constant attention of a single official than by the occasional meetings of men engaged in other occupations. Where non-technical advice given from purely philanthropic motives can be of service, it can be better secured by means of an advisory board not burdened with any details of management.

The system of bi-partisan boards adopted sometimes as a method of securing non-partisan administration, shows a curious confusion of two fundamentally different ideas; and the inevitable result of such a system is to make it impossible to locate responsibility for the administration.

EDITORIAL COMMENT.

Street Railway Franchises.

A recent decision of Judge John H. Baker, of the United States Circuit Court, on the right of the city council of Logansport, Indiana, to grant right of way to another street railway company over any street not already occupied by the company now operating in that city, is full of valuable points applicable to the control of all private corporations operating franchises for the use of city streets for any purpose. A full abstract of the decision is given in another department of this number. Special attention may be called to some of the most important features of the decision.

Many franchises for street railways, water and gas pipe systems, and the like, have been granted in indefinite terms, which have always been interpreted by the operating companies as giving them perpetual rights to the streets, and a few have definitely stated that the franchise is perpetual. While the general feeling has been that such a grant of power was not justified, it was long considered impossible to rescind a franchise already granted. The necessity of finding some way out of the difficulty has become more apparent as conditions have changed, and the opinion quoted is perhaps the most definite statement of the principle underlying the matter. The original grant is distinctly termed illegal, beyond the powers of a city council, and subject to modification at any time so far as its provisions thus transcend the legitimate functions of the city's governing body. In this case there is no ruling upon the right of the street railway company to perpetual use of the streets which it now occupies. In another case a few years ago the decision was in the same line as the present, but not so far-reaching. In the earlier decision, the right of a city council to require approval by the proper authorities before extensions of lines could be made, was definitely sustained. In this case the right of a city to repeal a franchise, so far as the use of streets not already occupied is concerned, is just as definitely stated. This is quite a long step in advance, and, being made by so eminent an authority, is not likely to be retracted. Claims based on illegal grants of public rights, no matter what their assumed value or what the loss from their withdrawal, are to be regarded as no more valid, or are to have no more consideration than private contracts by unauthorized persons or those based on fraud. The reasoning which leads to this conclusion is sound, and is based upon the statements of fact, that the fee to the streets rests with the abutting property owners and the city is simply a trustee, for the purpose of operating the streets, and has no power to alienate the streets as it would were the streets the actual property of the city. The grant to the company of rights to all the streets in the city was simply an offer which did not become operative until the company actually occupied the streets, and could be withdrawn at any time before the lines were constructed. By the earlier decision referred to, the city has also the right to regulate the entry of the company upon

A RESIDENCE SECTION ON RODNEY STREET, WILMINGTON, DEL.

new streets, and apparently can refuse permission so far as particular streets are concerned, even before the ordinance rescinding the franchise in general for such unoccupied streets is passed.

There are not so many cases in the operation of other public utilities to which the decision would apply as there are among the street railways, but the principles developed in the decision would seem to be equally applicable where such cases occur.

Court decisions really reflect the predominant opinion regarding the justice of methods in vogue or which it is desired to make common, and the final form is usually the development from a long series of decisions each throwing some new light upon a detail, or giving some different point of view, but all reflecting the average of enlightened opinion up to the date of their utterance, with an occasional radical departure made by some one with a more than usual insight into the results of the popular trend, either in the line of that trend, or, if that is not correct, in departure from it toward the true course of justice. A few years ago consideration for the vested rights of corporations operating franchises prevented the correction of many abuses. The basis upon which such rights rest is more carefully considered in the later decisions and the justice of claims is considered with less reference to the effect of decisions upon property depending upon them.

Departures from Specifications. A prominent example of departure from specifications occurred in the construction of the drainage system for the city of New Orleans, which calls up for notice the ever existing question of the amount of deviation from specifications which is allowable under a contract. It is often said that it is always possible for an engineer or board to break a contractor by requiring strict adherence to the letter of the specifications, and there is a large element of truth in the statement. The excuse sometimes made for making specifications so much stronger than the actual performance which will be permitted is that circumstances may arise in which the strict specifications will be necessary and the contract is drawn for such conditions, with the expectation of requiring good work though below the standard set for all parts of the contract, permitting such small deviations because the better conditions of the ordinary run of the work will permit them and still give stronger and more durable construction than can be obtained with the highest grade of work possible under the specifications in the parts under the worst conditions. It would seem that differences in specifications is the proper method of taking care of this difference in conditions, although the question of the application of the different specifications would then arise. Where strict compliance with specifications has not been customary, it is sometimes claimed that a reduction in specifications to fit the work actually permitted would be followed by a similar tendency of contractors to reduce the quality of work, so that, while satisfactory work can now be secured, it would then be impossible. This is a confession of lack of force which no engineer should be willing to make, even under the usual conditions of work with council committees and non-expert boards.

The departure from specifications in New Orleans is of a different nature, and much more excuse can be found for it. In fact, the best interests of the city often require departures of the same nature. It appears in the explanatory statement of Major B. M. Harrod, the engineer in charge, that he permitted in certain contracts the substitution of a certain brand of American Portland cement, under increased severity of specifications, in place of foreign Portland cement under the specifications forming a part of the contract, and thus saved the contractor nearly $32,000, on present prices of cement, possibly a less amount on the ruling prices at the time the change was permitted. Many accusations of collusion and of inferiority of the American cement have been made in the press, but the high standing of Major Harrod as a man and as an engineer, are sufficient refutation even if it had not been found impossible to prove collusion, and if it were not conclusively shown that the American cement used is better than the foreign cement which could have been used under the original specifications.

One objection of moment which has been sustained and has been admitted by Major Harrod, is that the city might have had at least a part of the benefit of the saving in cost. How far the city should benefit by the results of the efforts of the contractors to improve the work after the contract is let, when those efforts save considerable money, is a question which is open for discussion, and the arguments on the contractor's side are excellent. Many times the work is hastened and its quality actually improved by the ingenuity of the contractor and his employes in devising new machinery, new methods and new materials di-

ADAMS STREET, WILMINGTON, DEL.

rectly applicable to the work in progress and developed in connection with it. In this case the contractor made quite a strong argument to the effect that the American cement was superior to the foreign article. How much of the benefit resulting from this activity of the contractor in devising machinery and methods and in looking up suitable materials should accrue to the city? Does the city have any valid claim upon any part of it? Does not the result of the contractor's brain power belong to him? Is it not sufficient for the city that the quality of the work or the rate of doing it is improved, and is this not sufficient reason for departing from the specifications enough to permit the improvement thus made possible? In this case it is probable that the substitution of cement would have been permitted by any authority which had thoroughly investigated the subject, if there had been no question of difference in price. Possibly there was no question of price, the contractor rightfully assuming that the improvement in quality of work was sufficient advantage to accrue to the city. It would be possible for the city to demand a part of the saving in cost as the price of permitting the change, but the only apparent reason for securing any such benefit, in case of actual improvement in the work, is the power of the city to prevent any deviation from the letter of the specifications, the contractor being willing to "stand and deliver" a portion of his profit in order to secure the remainder.

The case of reduction in cost at the expense of the work is an entirely different proposition and any attempt at securing such concessions is suspicious upon its face. The quality of work desired should be stated once for all in the specifications, and, unless extra expenses reduce the amount of money available, so that the work must be cheapened or left unfinished, there should be no consideration of any such proposition. The contractor's share of any such saving is only a part of the loss of profits due to the smaller amount of money expended.

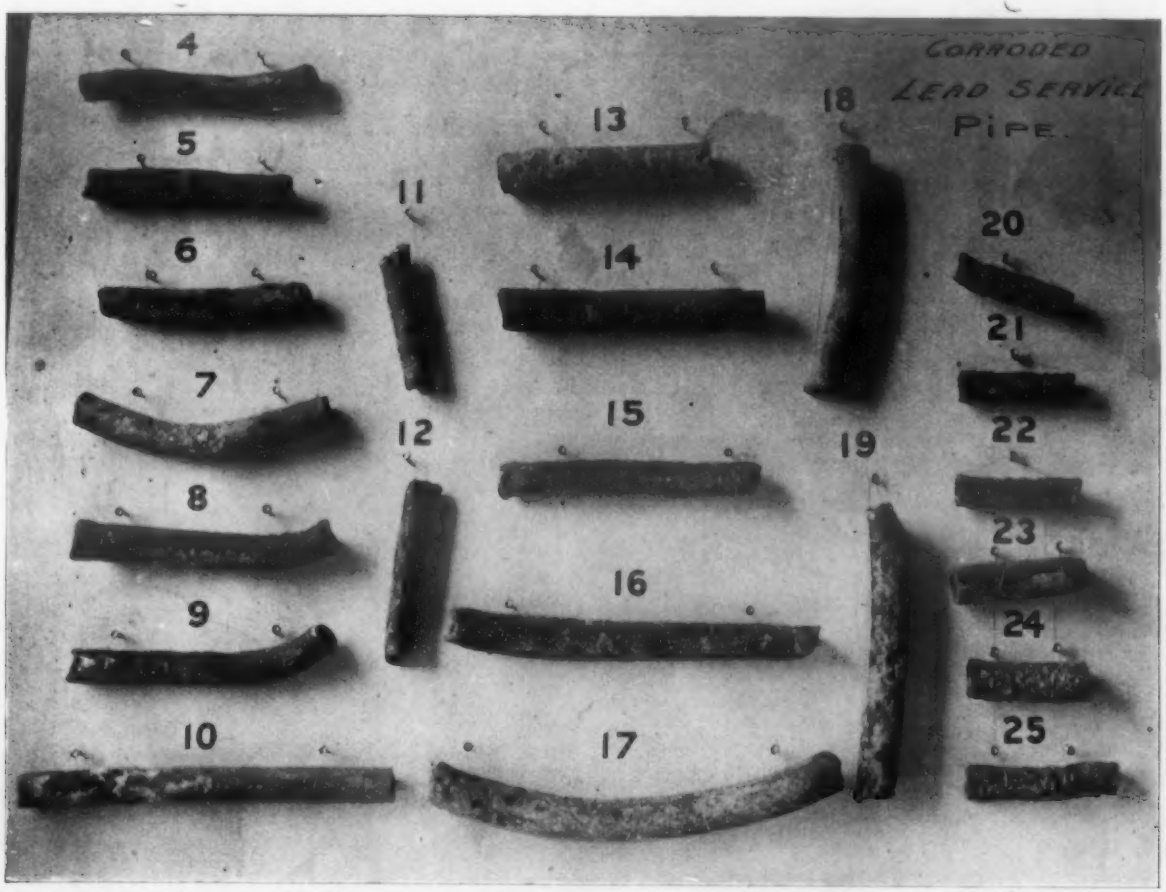
The most important objection sustained and admitted is that the change was made without referring the matter to the board in control. Undoubtedly the engineer had general instructions from the board regarding the ordinary occurrences on small scale of a similar nature, and he classed this change under the same head, but it is evidently of considerable importance and the engineer is subject to criticism and accusation of corrupt practices if he makes the change upon this general authority, so that it should have been referred to the board for its action. It is difficult to draw the line between matters which the board does not wish to bother itself about, and those which it should seriously consider, and the engineer conscious of his own integrity is quite likely to take the responsibility of decision of too many of the questions which arise. It is better to err on the side of using too much of the board's time than on the side of assuming too much responsibility.

Specifications for Concrete.

The progress toward uniformity in specifications for Portland cement has been so rapid, in the face of the great change in conditions in the cement market, and perhaps on account of it, that the discussion of specifications for cement has largely given way to that of specifications for concrete. The variation in specifications for practically the same duty will be seen on reading the chapter on specifications for the use of cement in the new edition of the "Directory of American Cement Industries and Hand-Book for Cement Users," now in press. Some valuable work is being done in the study of the question of the most economical mixture for concrete and of that of the strongest mixture, both in Germany and in this country, and the results which are now available are given in the chapter on uses of cement, in the book referred to. Mr. S. B. Newberry reported some of the results of German experiments to the recent meeting of the Indiana Engineering Society, and much of his paper is given on another page.

The principal point made by him is that there is a most favorable proportion of sand and broken stone or gravel, and that the amount of sand necessary to fill the voids in the stone or gravel fixes this proportion. Any other proportion of sand and stone or gravel reduces the strength of the concrete, the proportion of cement in the total remaining the same. To increase or decrease strength of concrete with the utmost economy, therefore, it is not the proportion of mortar which is to be varied, but the proportion of cement alone. Sand and stone must remain in a fixed proportion, to be determined by experiment for the materials to be used, and the strength of the concrete can then be increased by increasing the amount of cement.

How far the increase in strength can be carried by increasing the proportion of cement is a question not considered in this



ELECTROLYSIS OF WATER SERVICE PIPES, ROCHESTER, N. Y.

paper. That it will reach a limit somewhere near the proportion of cement necessary to fill the voids of the combined sand and stone or gravel is indicated by a few results from other experimenters. Valuable work is being done in several laboratories in this line and some facts have been discovered which will soon lead to a more scientific selection of materials and their proportions, and within a very few years the present variations in specifications for the same class of work will largely disappear.

Development of Interurban Railway Traffic. In line with the discussions of some of the problems of interurban railway traffic, which have appeared in this magazine from time to time, is a paper on the competition of steam and electric parallels, by C. H. Davis, read before the Canadian Society of Civil Engineers, March 13. The paper was written some time ago, and its statistics are not brought down to date, but the general statement is made that observation shows that the general conclusions would not be modified materially by later information. A number of laws of passenger traffic are laid down, the definite results of which are not readily determined, though their general results are quite evident.

The total cost of travel for the round trip is an important factor, the travel increasing somewhat less rapidly than the cost decreases. In this total cost must be included expense of getting to and from the railway line. In general the operation of this law is favorable to electric roads, their ability to take up and set down the passenger, with a minimum of extra cost being greater than that of steam roads. Another item must be taken into account in the neighborhood of large street railway systems. The uniform fare throughout the city limits which prevails in almost every city permits the development of all sections of the city at once. The imposition of an additional fare, no matter how small, puts a handicap on the growth of the section to which it applies. The removal of the extra fare induces an immediate increase in population which increases the traffic upon the railway line. A fare cut in half will very shortly much more than double the travel.

The time consumed in making the round trip is another factor deemed by Mr. Davis to be largely in favor of the electric road. This is true for reasonable distances where the trains on steam railroads are not too frequent. The time consumed is made up of the time spent on the railway car, the time getting to and from it and the time spent in waiting for the schedule time of the train to arrive. Where one train a day is run, the total time might be anything from the time spent on the train to 24 hours plus that time. The more frequent the trips the less the time lost in waiting for train after the decision to go is made. When the greater convenience of reaching the electric line is considered, the two may very easily make up for a large excess of time on the electric road between centers, and if limited cars are frequent enough, the advantage of the electric line may be carried a long distance, say a hundred miles, under present conditions.

Mr. Davis's observation confirms the statements, heretofore made by the writer, that the traffic on electric lines is almost entirely new, induced by the greater convenience and less cost and less total time consumed. Where the steam railroads lose traffic it is soon more than regained by the general development of the district largely hastened by the electric road, so that the final result is distinctly of advantage to the steam road. In this connection Mr. Davis analyzes the contentions of the Connecticut railway companies in their efforts to restrain the building of electric roads and shows that the railroad companies have furnished the arguments to demonstrate that the electric roads will be a material aid in increasing their own business.

The operation of electric cars by the steam roads is suggested, the cars being run between centers of population on the regular railway tracks, fitted for electric cars, and running as local cars through the streets of such centers. Possibly this would be the best method, but a proper combination of local lines to pick up the passengers and occasional centers to transfer passengers to steam trains for transit between centers would seem to be capable of development into a greater system, and would retain the most advantageous features of both methods of transportation.

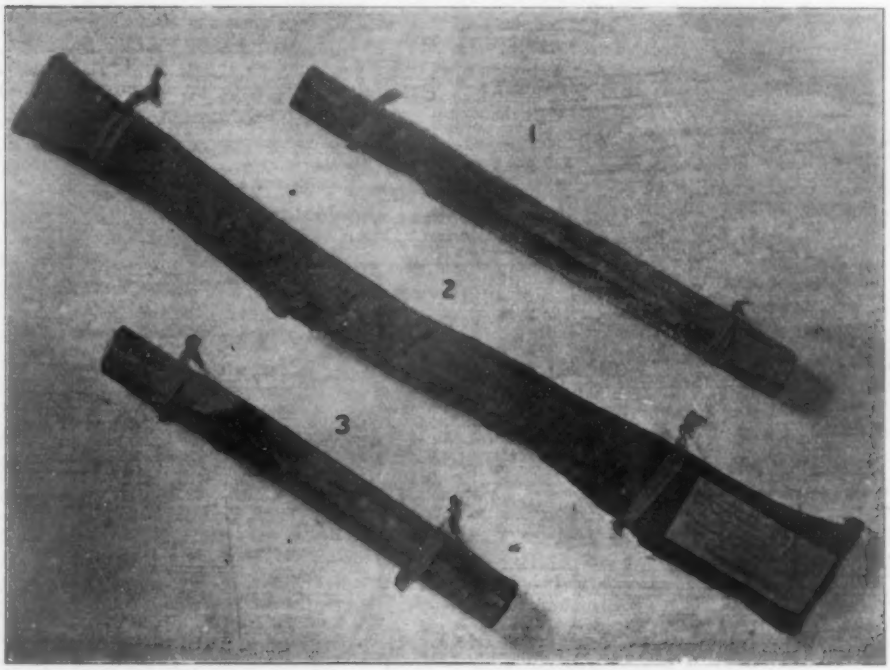
THE QUESTION DEPARTMENT.

SPECIFICATIONS FOR GRANITE MONUMENT.

I would like to find standard specifications for small granite monuments, best extra dark Quincy granite, A1 polish, best lettering and tracing; in fact, the very best material, workmanship and finish. *L. F. Gottschalk, Columbus, Neb.*

There do not seem to be any standard specifications for this class of work, those engaged in such work saying that it is difficult to give specifications in full without having some design, as every design calls for specifications to cover its own character. Mr. J. H. Mahoney, of Indianapolis, suggests a general form of contract and specifications for the average monument builder, giving form for stating dimensions, and saying that "said monument is to be best quality of — granite, and to be free from all blemishes, of uniform texture and color, all work to be first-class. Said monument to be inscribed as follows: On base, the family name in letters as shown in tracing, raised one-half inch, with polished faces." Details of delivery and payment are also provided for.

Specifications for large monuments of public character for soldiers and sailors, contain two or three paragraphs which may be applied to the answer of this question: "All polished work shall be finished true, 'out of wind,' free from 'dumps,' 'pits,' 'starts,' and to the dimensions shown on the drawings, and the gloss shall be the highest obtainable, no dull spots being allowed. All carving to be true to the drawings and approved models, the lines of which shall be exactly duplicated in the granite by the carvers. The treatment of the carving must be subject to the approval of the architect or his representative." Three kinds of lettering are described. "By 'square raised' letters it is intended that the sides of the letters shall be at right angles to the surface of the stone from which they project; by 'square sunk' letters, the letter should be sunk in from the surface of the stone in which said letters are placed, with edges or sides of the same at right angles to the finished surface of the stone where said letters are placed; and 'V-sunk' letters are intended to be those forming a V, the bottom of which shall form a right angle, all as shown on the drawings. All cut work (chisel work) in connection with lettering shall be 'hard' and 'solid,' free from 'stuns' and 'bruises,' with all edges or arrises 'chipped' to a true and even line, free from 'nicks' and with sharp true corners and miters or angles of



ELECTROLYSIS OF ELECTRIC CONDUITS, ROCHESTER, N. Y.

intersection. The contractor shall employ only the most expert workmen on this part of the work, and shall see that all lettering shall be in strict accordance with the full-size details therefor, and to the full satisfaction of the architect and owner in every particular." Material is specified as follows: "The monument is to be constructed of the best quality of ——— granite from the ——— quarry of ———, said granite to be free from 'shakes,' seams, starts, scales, sap, 'white horse,' 'black horse,' streaks, or any imperfections whatever, and to be uniform in grain and color.

A BRIDGE PROBLEM.

It is proposed to erect a bridge where the distance between mean high water marks is 350 feet, between low water marks 100 feet, depth at low water 2 feet, average rise 3 feet and extreme rise 8 feet. On one bank a ledge of rock projects 2 feet above mean low water, the other bank is quite loose sand. The river bed is quicksand assumed to be 16 feet deep, and under the sand is said to be tough clay for indefinite depth. An existing pile bridge or trestle with 16 feet spans has stood ten years. Soundings about piles of this bridge show holes 2 to 3 feet deeper than surrounding water. The center pier of a railroad bridge shows 5 to 6 feet greater depth of water. The county is not able to build masonry from bed rock, assumed at 30 to 40 feet, or even from bed clay, assumed at 16 to 20 feet.

Would it be good practice to found piers by sinking bearing piles to, or if possible 2 feet into, the substratum of clay in 3 rows of 7 each, saw off at extreme low water, put in two feet of concrete around heads and over piles, in two layers of 12 inches each, then build up piers of rather soft native sandstone in uncoursed rubble laid in cement? Would it be better to use grillage under the concrete? The bridge is intended for light country travel, and a 12-horse power threshing outfit would probably be the heaviest load. Which would be the cheapest, four 100-foot spans or two 200-foot spans?

What is the average price per pound f. o. b. at factory of fair quality, medium weight highway bridges?

What is the average weight of 100-foot spans 14 feet and 16 feet wide in the clear, and of 200-foot span, 16 feet wide?

B. S. Reeves, County Surveyor,
Guthrie, Okla.

The character of the bed of the river and the strata below is so important a factor in the solution of this problem, and a full, personal knowledge of it is so necessary as a basis for designing a safe structure, that the investigation should be intrusted to an experienced and competent engineer, with instructions to determine just what the conditions are, before making his design. Economy is evidently a very large factor, and the information noted is even more necessary in making the cheapest design which will be safe. A few hundred dollars spent upon an examination of the site, and the making of plans by an expert bridge engineer, will undoubtedly save thousands in the long run, and perhaps several times this preliminary expenditure in the first construction. The cheapest length of span must be obtained from a consideration of the relative cost of bridge spans and piers, and the first requisite in the solution of the equation is the cost of the piers. The cost of trusses can be readily computed for assumed conditions, but the cost of piers can not be approximated very closely until the designs for them have been worked out, and the strength and stability required to be supplied are the most prominent items in the design. As stated, these can only be judged safely and economically by an expert on the ground, after sufficient examination of the materials underlying the river.

Bridge materials cost 1.6 to 2 cents a pound, and recent contracts indicate that a bridge of the size mentioned, erected in place, would cost about 4 cents a pound plus the transportation from the works to the place of erection.

In Johnson's "Theory and Practice of Modern Framed Structures" ($10) it is stated that for the ordinary truss span with iron trusses, bracing and floor beams, with stringers or floor joists of wood, the weight of iron per foot of span with a live load capacity of 1,200 pounds per linear foot, is closely approximated by the formula Weight per lineal foot of each truss equals twice the length of space plus 50. Hand rail should be added and the weight of floor system, which will depend on the width of bridge and the concentrated load assumed. For 100 feet span and 15 feet clear width, this formula will give 500 pounds weight for trusses, and if the floor is assumed to weigh 500 pounds, the total weight is 1,000 pounds per foot, or 100,000 pounds for the bridge. Extending the span to 200 feet, the weight will be 900+500 or 1,400 pounds per foot, or 280,000 for the whole bridge.

FLOOR FOR BRIDGE—PARK COMMISSION—PILING CONTRACTOR.

What do you consider next best to oak planks for covering bridges? Oak is hard to get and too expensive.

Is the creation of a park commission outside of the city councilmen advisable in a small town of 6,000 inhabitants?

What firm can supply piling for the construction of ice-breakers in streams?

Andrew J. Eckstein, County Commissioner,
New Ulm, Minn.

Eau Claire, Wis., has a long 4-span bridge which was floored in 1899 with rock elm, 4 inches thick. The city engineer will doubtless be willing to report regarding the satisfaction it has given. A good floor can be

made of 3-inch blocks on end, similar to the ordinary wooden pavement. Creosoted yellow pine makes quite a durable pavement. The ordinary white cedar round blocks are not as satisfactory as rectangular blocks.

A park commission may have the advantage of continuity in office, if the method and times of appointment are properly arranged. This should insure a plan to which to work and as close adherence to the plan as the appropriations for park purposes will permit. If the commissioners serve without pay and can call on the city engineer for his assistance when needed, the results will be more satisfactory so far as quality of work is concerned, and usually so far as cost is concerned.

The inquiry for piling contractor is submitted to our readers, who may be able to suggest some one who is accessible to our correspondent. Newman & Hoy, of St. Paul, is one firm.

WHAT WILL HASTEN THE SETTING OF HYDRAULIC CEMENT?

What will hasten the setting of cement made from rock containing carbonate of lime 43.05 per cent.; carbonate of magnesia, 26 per cent.; silica, 22.10 per cent.; alumina, 5.05 per cent.; and peroxide of iron, 1.08 per cent?

Subscriber, ——, Ga.

This is a question for a cement chemist, the cards of several of which will be found in our advertising columns. Possibly some of our readers will be willing to volunteer an opinion.

COST OF MAKING CEMENT.

I wish to ask for information in regard to the manufacture of cement. Can you give me an approximate estimate of the cost of manufacture from the raw materials? I have a deposit of chalk composed of carbonate of lime, 90 per cent., carbonate of baryta, 5.5 per cent., alumina, 4.4 per cent., and a good clay to mix with it. We can lay the chalk and clay down at the factory at an expense of $2.75 a ton, and obtain slack coal at $1.56 a ton. Can the cement be manufactured at a profit, selling at $15 a ton?

Subscriber, ——, Neb.

The composition of the clay is quite as important as the composition of the limestone. Whether the clay and limestone available for use together will make good Portland cement, is a question which should be submitted to chemists who are expert in the treatment of cement materials, and who can test their conclusions by laboratory or factory manufacture of enough cement to form a judgment of its quality. As regards cost of manufacture, the managers of factories in operation are naturally very careful not to give any definite information. Several new companies have given estimates in more or less detail of the cost of making cement as a basis for procuring subscriptions to stock and bonds. While these estimates may not always be unprejudiced, they are in some cases made by engineers whose reputation for ability and integrity is unquestioned. In one case in Pennsylvania in which the dry process is used, where the cost of getting the cement rock to the works is estimated at 20 cents a ton, the cost per barrel of finished cement is estimated at 65 cents a barrel of 380 pounds net, or $3.42 a ton. In a Michigan case, using marl and clay and the wet process, for a capacity of 1,000 barrels a day, the cost of delivering materials was estimated by the engineer at 32 cents a ton, and the cost of finished cement at 73 cents a barrel, or $3.84 a ton. If the capacity were estimated at 500 barrels a day, the cost per ton of delivering materials would be increased about 50 per cent., and the cost of cement per barrel about 30 per cent. Coal in this case was estimated to cost $1.50 a ton. These Michigan estimates include all items from supply of materials to cost of superintendent and sales, and an allowance for deterioration.

INFORMATION ABOUT THE CEMENT TRADE.

I am desirous of obtaining data regarding the condition and prospects of the Portland cement business, comparative figures regarding the production, consumption and importation of the past year, or other figures pertaining to this industry.

Watson Vredenburgh, Jr., New York City.

The new edition of the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5) will contain the information and discussion of conditions desired, and also some consideration of foreign markets and foreign cements. MUNICIPAL ENGINEERING is the best medium for keeping track of the cement industries from month to month. Special reference is made to the items under the heading of "Cement" in the department of "Machinery and Trade." Articles upon various phases of the subject appearing within the last six months are as follows: "Cement for South Africa," page 41, July, 1901; "Cement Plants and Manufacture," page 329, "The Production and Use of Cement in the United States," page 339, "The Portland Cement Industry in Michigan," page 343, "Indiana Cement Industry," page 348, November, 1901; "The Use of Portland Cement in the United States," page 44, January, 1902; "Production and Use of Cement in the United States," page 66, February, 1902; "Cement Manufacturers on the Pacific Coast," page 163, "Cement Manufacturers in the South," page 164, "The Portland

Cement Industry in Mexico," page 164, "Prices of Cement in Canada," page 179, March, 1902.

WATERPROOF CEMENT FLOOR.

A laundryman desires to put a cement floor in the second story of his building, with machinery and more or less water in the use of the mangle. He thought it would do away with water running through the present wood floor. The room is about 30x60 feet, and the floor is reasonably supported by heavy timber and joist. We desire to know whether the vibration of the machines would cause the floor to crack, and whether the hot water, with such chemicals as are used in a steam laundry, might work injury to it, and what thickness would be advisable? *Subscriber, Decatur, Ill.*

Regarding the effect of heat on the cement floor and method of making provision for it, reference may be made to the article on page 167 of the March number on "Cracks in a Cement Floor." The separation of the floor into blocks with elastic filling between them will also reduce the tendency to cracking from vibration of the machinery. It is possible that two inches would be sufficient thickness, but three inches would be better, if the floor beams and joists can support the weight. If cinder concrete is used the weight will be somewhat reduced from that of broken stone.

EFFECT OF SALT ON CEMENT WALKS.

With reference to the effect of the application of salt upon cement walks for melting snow and ice, regarding which a question was asked and answered on page 91 of the February number, we have a report from E. J. Evans, of Red Oak, Iowa, stating that a walk laid last September is perfect in every respect except where salt was applied in freezing and thawing weather. He asks if the salt would have affected the walk after a year's exposure, the time of final set of cement in cold weather being uncertain.

The fact that the salt is injurious overbalances any theory which would indicate that it would not seriously affect the walk. It is not probable that there is any chemical effect of the salt upon the cement or other materials in the walk. The mixture of salt and ice or snow while melting produces a temperature of zero. This temperature is doubtless produced very promptly upon application of the salt, and we have a rapid contraction of the surface of the walk, which does not affect the interior of the block so promptly. This may be sufficient to crack the surface, and possibly separate the top layer from that below. It is the reverse of the expansion which takes place in summer, but may have a like disintegrating effect. If the cement has not thoroughly set, the disintegration would be more likely to occur, and if the walk is not thoroughly well laid and the two layers completely united, the same would be true. It would seem that a walk which has been able to withstand the greater variations of temperature in summer should safely pass through the treatment with salt, unless the rapidity of the change in temperature is enough greater to prevent the distribution of the temperature stresses through the whole mass.

CEMENT STEPS.

In response to the inquiry under the above heading, which appeared on page 160 of the March number, Mr. R. B. Clement, of Walkerton, Ont., contributes the following experience:

"Nearly two years ago I built two tiers of cement steps, eleven in one and ten in the other, leading down a hill side. They were exposed to the frost all last winter, and came out without a crack, and no doubt will do the same this winter. I first had the earth removed about 20 inches, and filled the excavation to the original surface of the ground with small field stones, well pounded down with a large sledge. I then put on a coat of 3 inches of coarse granite and cement, and had it well rammed down. After it had set one day and night, I began the steps. I put a wide 1½-inch plank each side of the walk, 4 feet 10 inches apart, 4 feet for the length of steps and 5 inches at each end for a side railing, and then built in the side plank for each step, setting them 14 inches apart, though 16 inches would be better. I had these cross planks dressed and gouged out along the edge so that each step has a 2-inch half round mold on it. I started the steps at the top, so that there would be no temptation to step on them while at work. The concrete was thoroughly well tamped into place. To form the side rails, the outside plank and one 5 inches from it, cut to fit the steps, were used. The top of this railing, which was about 6 inches high, was neatly rounded off with the trowel. In joining on the rail to the steps, plenty of water was kept on the steps at each end to make it stick. The surfaces of the steps were troweled off as soon as the planks were removed All planks were removed after two days. Plenty of tallow was used on them to keep the cement from sticking. The foundation concrete may be one part of cement to five or six parts of gravel. The concrete for the railing and

for the outside two inches of the steps should be quite rich in cement, say two parts of cement to one of coarse, clean, sharp sand. The steps should be thoroughly wet frequently for three or four days after the forms are removed to prevent checking and cracking while taking the final set. When the surfaces are thoroughly dry, thorough rubbing with coarse sandpaper and an old rasp will give a fine appearance to the surface. Anything built without a solid foundation that frost, rain, or sun can not touch, will be work in vain.

METHOD OF REPLACING WEARING SURFACE OF CEMENT WALK.

The following from J. Kennel, of Dayton, Ohio, gives a method of replacing the wearing surface of walks and floors which promises success. The question of great variations in temperature will arise, however, and while this method should ordinarily be successful, the greater possibility of separation of the layers must be considered in deciding to use it. Mr. Kennel says:

"I see you claim you can not replace wearing surface on old cement concrete walk. You will have as good a walk as you ever had if you mark old seams or joints and put back-strips on side of walk, take a pick and take off the top, then sweep the concrete *clean*; have your top coat ready mixed, 1 cement to 2 sand, and not mixed too thin; then take a half bucket of water, stir in neat cement until you have a thick paint, then pour it on the concrete and sweep well with a broom and put on the top before the neat cement dries. I have a walk made that way twelve years ago which still holds, and often repair walks so, where top has become loose, and have never had bad results from it."

CONCRETE ARCHES.

Does the "Directory of American Cement Industries and Hand-Book for Cement Users" give plans of arches and other works in which cement is used? I want to build some concrete arches and would like to know if I can get the required information as to the plan of building, sizes of I-bars, etc., that will be required. *James Warren, Surveyor, Walkerton, Ohio.*

The first edition of the "Directory of American Cement Industries and Hand-Book for Cement Users" gave specifications for cement and concrete for arches, but no plans. The new edition will go into more detail in regard to them and give some additional data. It would not be possible to give plans which would be applicable to any considerable number of special cases, the details of foundation, span, rise, backing, loading, etc., varying so much that almost every arch must have its special design. When steel is used in reinforcement, this is also true. The patentees of the various systems using steel reinforcing have standard designs which are modified as necessary to suit local conditions. The pages of MUNICIPAL ENGINEERING from month to month give illustrations and descriptions of actual constructions.

CEMENT PAVEMENT WORKERS' TOOLS.

Can you refer me to a dealer in cement pavement workers' tools? *E. Kenney, Creston, Ia.*

Among the dealers in cement paving tools may be mentioned W. H. Anderson & Sons, Detroit: The Contractors' Tool Company, Philadelphia, and the Orr & Lockett Hardward Company, Chicago. For concrete mixers reference may be made to answers in this department in recent numbers of the magazine.

ORNAMENTAL ARTIFICIAL STONE.

I am thinking of starting the manufacture of artificial cut stone from Portland cement. The only thing, in my opinion, that prevents it taking the place of natural stone to a great extent is the dead cement look that all such work has which I have seen. Does your new Directory give any directions for coloring concrete to imitate granite, marble, and the different colored sandstones? *T. P. Groat, Detroit, Mich.*

The nearness of the approach of the exterior appearance of an artificial stone block to that of natural stone depends upon several important details: The materials used for making the stone; the proportions of cement to such materials; the proportion of water; the method of putting into molds, so as to put the proper proportion of each ingredient on the surface; the coloring matter used; the rate of setting. All these must be carefully worked out for the materials to be used, and the operators of the machinery must become sufficiently expert to do their part successfully. The "Directory of American Cement Industries and Hand-Book for Cement Users" ($5) contains general directions regarding methods of mixing, proportions of materials, coloring matter, etc. One error frequently made is the use of too great a proportion of cement. Certain chemicals which hasten the setting of the cement and increase its early strength seem to have a favorable effect upon the appearance of the stone, also. There are several such combinations now on the market, which are held as trade secrets. Some such additions have been shown by experiment to be valuable and others are under test. Those who have succeeded in securing close

imitations of stone in their practice are also disposed to retain their knowledge as a trade secret. However, a process which will answer for one class of materials must be modified, perhaps greatly, for another class, so that each manufacturer must expect to expend some time and money in experimenting to produce the best results.

A slight tool dressing of artificial blocks is sometimes resorted to in order to imitate more closely the appearance of worked stone, the smoothness of surface and the smothering of details of tool marks in a practicable mold being apparently objectionable to many. Familiarity with the ordinary appearance of good artificial stone work will ultimately remove most of this sort of objections.

FIRE-CLAY IN THE SOUTH.

Can you give us some information about the location of deposits of fire-clay in the south?

The Indiana Wood Fiber Plaster Company, Indianapolis, Ind.

Deposits of fire-clay are doubtless located near the following points, at which manufacturers of fire-brick and clay fireproofing are located: Ashby and Bessemer, Ala.; Texarkana, Ark.; Bluff Springs, Fla.; Atlanta, Macon, Milledgeville and Stevens Pottery, Ga.; Ashland, Firebrick, Fire Clay, Louisville, Middleborough, Olive Hill, Owensboro, Ky.; Covington and New Orleans, La.; Baltimore, Cumberland, Elkton, Mt. Savage, North East, Salisbury, Md.; Ocean Springs, Miss.; Deepwater, Fulton, Jackson, Kansas City, Mexico, Pacific, St. Louis, Mo.; Socorro, N. M.; Pomona, N. C.; Aiken, S. C.; Chattanooga, Cleveland, Jasper, Tenn.; Athens, Gainesville, Hallettsville, Laredo, Tex.; Buena Vista, Va.; New Cumberland, Nuzums, and Wheeling, W. Va.

Can our readers add to this list?

PAVEMENT FOR IOWA TOWNS.

We are just now about to begin paving, and one of the questions which is being freely discussed is the best kind of paving for Iowa mud, particularly southwestern Iowa, where we have it deep and black. *B. J., Red Oak, Iowa.*

Perhaps the following suggestions will be of value in making a comparison of the various materials ordinarily considered, viz., asphalt, brick, macadam, and the comparatively new bituminous macadam.

The effect of the mud, and of the water which it contains, upon asphalt pavement is a serious question. It is probable that unless the streets are kept clean, asphalt would not be as durable as in other places. Some varieties of asphalt are less susceptible to the action of mud and water than others, but pavement mixtures, unless the ingredients are specially chosen, are all of them likely to disintegrate more or less if surfaces are not kept clean. The question of cost, and especially of cost of making repairs, is one which is prominent, and the difficulty of securing prompt repair where there is but little pavement to look after is serious.

Mud seems to have some effect on brick pavement, especially on the joints, when the pavement receives occasional cleanings, so that as good service may not be given as if the streets could be kept always clean. In a district under the conditions described it is a practical impossibility to keep the streets clean at all times. Streets of good brick on a well-prepared foundation have given good satisfaction. Complaints regarding brick streets for prairie towns have all come from poor material or insufficient foundation. Thorough drainage is one essential of a good foundation.

Well compacted macadam has given reasonable satisfaction in some cases. Unless thoroughly bound together, the sticky mud on wagon wheels will pick up loose stones and carry them off, finally carrying away the entire pavement in spots. It is difficult to clean a macadam street during or after a muddy season, without removing part of the stone surface, and frequent and thorough repairs will be necessary.

It is possible that the use of bituminous material for cementing the stones together will remove the objections to macadam, holding the wearing surface in place and making it more uniform and easier to clean, without disturbing the pavement itself. Bituminous macadam has not yet been subjected to the peculiarly severe conditions named by our correspondent, but experience with it under more favorable circumstances indicates a possibility that it will give satisfaction.

MATERIAL FOR STREETS IN SMALL CITY.

We want to pave a street in our town 700 feet long by 40 feet wide. Can you suggest the material to use and a good contractor to do the work?

J. E. Moyler, Franklin, Va.

Doubtless the question of cost will enter into the consideration, so that one not familiar with the local conditions and prices of materials can only suggest. It is probable that the answer to the question as to the best pavement for Iowa towns, elsewhere in this department, will be fairly applicable to this case, and that bituminous macadam may be well suited to the condi-

tions. Should asphalt, brick or macadam be chosen, the names of reliable contractors can be found in the business directory in our advertising pages under the headings "Asphalt Pavements," "Contractors," "Macadamizing," "Paving Contractors." Regarding bituminous macadam, reference may be made to the Warren Brothers Company, of Boston, Mass.

TESTS OF PAVING BRICK.

Please inform me where I can obtain a table showing the relative tests of paving brick.

A. Cassil, City Engineer,
Mount Vernon, Ohio.

The back numbers of MUNICIPAL ENGINEERING contain such tables. The latest which has appeared will be found on page 97, August, 1901. Another will be found on page 298, May, 1898, and others in preceding volumes.

EXPERTS ON CONCRETE.

We have a special construction using concrete, and would like to be referred to engineers expert in the value of this material, who can give us opinions regarding its suitability and value for our purposes, which would be accepted as authority.

Subscriber, Evansville, Ind.

A study of the advertisements of engineers in our advertising department will indicate who among them are making practical use of concrete in construction. In some quarters the opinions of expert contractors have special weight, and a similar study of the advertisements of contractors may be of advantage. Some experts in concrete will be found among them.

WHAT VARIATIONS IN SPECIFICATIONS AND BIDS ARE PERMISSIBLE IN INDIANA?

Most of the cities in Indiana give an opportunity for bidding upon different kinds of material in some of the details of a street pavement, while one or two claim that the law does not permit such variations. Thus Indianapolis permits contractors to bid upon limestone curb and cement concrete curb, and the board of public works makes the choice after bids are opened and before the contract is let, while Muncie chooses the kind of curb which is to be used before the specifications are completed, and receives bids upon but the one kind. How much such variation is permissible? Upon what grounds do Muncie and one or two other towns base their restrictions? *Subscriber, Clinton, Ind.*

Inquiry of City Engineer Wood of Muncie brings the information that their city attorney has not rendered a definite opinion upon the matter, but the council, under general legal advice, has held that "the council, with the advice of the engineer, must determine the kind of improvement and the material to be used. It is supposed that they have determined these matters after considering the kind and nature of traffic that is upon the street or alley to be improved. The property holder is certainly not the one to determine these matters, as he is not qualified in that line. There is no comparison between granite and sandstone, etc. Our legal advisers have always held that you should determine definitely the kind of improvement before it is ordered, and have always advised that one order was good law and reasonable, and not two;" and further, "the declaratory resolution is to give property holders a chance to be heard, and the resolution ordering the work follows. I do not see any excuse for ordering two or more kinds of improvement. The statutes certainly do not indicate anything of the kind. Monopoly is no excuse for it. All good things are protected."

The principle upon which Indianapolis and nearly all the other cities of the state proceed is that the statutes are open to such reasonable interpretation as shall result in the best for the taxpayer.

If the principle of restriction is pushed to its logical conclusion under the reasoning in the letter from Muncie, no choice whatever can be permitted. There is no more comparison between the best and the poorest material offered as paving brick than between granite and sandstone for curb, and the same is true of the best and poorest grades of asphalt. The brand of asphalt or make of brick should therefore be chosen before the bids are called for.

On the other hand, the courts would probably not uphold a construction of the law which would call for bids for asphalt, brick, stone and macadam for the same street, choice to be made after the bids are opened. This is possible under the laws of Nebraska, the property owners being given the opportunity to make the choice after bids are opened and before the contract is let, but is probably impossible under the Indiana law.

While no comprehensive decision covering the entire principle involved has been rendered, those on file indicate that a reasonable latitude of choice between materials for details of pavements will be allowed. Thus the material to be used for filling in brick pavements, the composition and the particular make of brick, the particular asphalt, the material for curb, the kind of cement and stone to be used in concrete foundation, have all been left open to decision by the board of public works or the city council after the bids are opened, on the principle that such variations as will not modify the pavement so much as to change its character appreciably, can be permitted

in order that there may be free competition and consequent control of prices of materials actually used. Slight modifications of materials, where cost was not changed, have even been made after the contracts were let, which were sustained by the courts. But in case a choice of material for the pavement was desired, for example between asphalt and wooden block, two declaratory resolutions for paving the same street have been passed and the property owners given the opportunity to choose by filing a legal remonstrance against the pavement which was not desired.

METHODS OF MAKING STREET PAVING ASSESSMENTS IN INDIANA.

Will you kindly inform me through MUNICIPAL ENGINEERING how the different cities throughout Indiana are making assessments for street paving under the law of 1901, whether by the lineal feet frontage or otherwise?

John C. Butler, City Engineer,
Plymouth, Ind.

At the meeting of the Indiana League of Municipalities last fall, reports from the cities represented showed that assessments are actually made by the frontage method although the machinery by which the assessments are made is changed. In Indianapolis the board of public works of the administration preceding that now in office devised a plan for relieving corner lots of a part of the double assessment which they would otherwise receive, but it is subject to modification when occasion seems to require it. The practical operation of the law of 1901 seems to have been, not to modify the general application of the ordinary frontage rule for making assessments, but to give an opportunity for the correction of the few cases of injustice which occasionally arise under the former inflexible rule.

BOOKS ON ASPHALT.

Will you kindly inform me where I can secure Delano's "Twenty Years' Practical Experience of Natural Asphalt and Mineral Bitumen" and Tillson's "Street Pavements and Paving Materials"?

C. H. Perry, Chicago, Ill.

Municipal Engineering Company can supply them, the former at 85 cents and the latter at $4.

LAKE AND LAND ASPHALT.

If you have anything on Trinidad pitch lake asphalt and Trinidad land asphalt I would like to have it. *S. W. Rathbun, Marion, Iowa.*

This ground has been covered often and in detail in MUNICIPAL ENGINEERING in former years, and the general conclusion is the same as that which may be drawn from the reports upon this subject made by various cities to Mayor Rose, of Milwaukee, an abstract of which appeared on page 249 of MUNICIPAL ENGINEERING for October, 1901. This conclusion may be very nearly expressed in the words of the report from the city engineer of Joliet, Ill., as follows:

"I believe that the merits or demerits of an asphalt pavement are to a large extent independent of the source of the asphalt, but depend more upon obtaining a mixture having proper proportions of asphaltine and petroline in the bitumen, and also upon the use of a sand uniformly graded as to size, from very fine to coarse. I believe another very important point is the mixing and workmanship, as well as good judgment to be used in preparing a mixture to be used in any certain street, according to the class of traffic, etc."

Of the cities making reports, ten use both kinds of asphalt, six use only pitch lake asphalt.

The discovery of other deposits of asphalt and asphalt rock suitable for pavements has broadened the discussion, which now often includes five or six kinds of asphalt materials. The opinion from Joliet, with little modification, is applicable in any case.

References can be given, if desired, to discussions which are several years old, going into technical details. Most of these were somewhat partisan in their character, being prepared for use in contests for adoption of brands of asphalt for use in city pavements, or in general attacks upon competing materials.

MANUFACTURERS OF EXPANDED METAL AND WIRE LATHING.

Will you kindly give us a list of manufacturers of expanded metal and wire lathing?

K. Dykema & Son, Grand Rapids, Mich.

Expanded metal is used by many branch companies covering the entire country. Information can be obtained of the Expanded Metal Fire Proofing Co., 860 Old Colony building, Chicago, Ill. Among the makers of wire lath are Barber Wire and Iron Works, 44 Dearborn street, Chicago; Clinton Wire Cloth Co., Clinton, Mass.; Gilbert & Bennett Mfg. Co., 42 Cliff street, New York; Roebling Construction Co., 121 Liberty street, New York; F. P. Smith Wire and Iron Works, 100 Lake street, Chicago; Frederick Voss, 617-621 Austin avenue, Chicago. All these not located in Chicago have branch offices there. There are other manufacturers of metal lath, such as the Sykes Steel Lath Co., Curtis Steel Roofing Co., and International Metal Lath Co., all of Niles, O.; Berger Mfg. Co., Canton, O.,

John W. Rapp, 307 E. 94th street, New York; Rasner & Druger Co., 2d and Ferry streets, Pittsburg, Pa.; Schratwieser's Metal Lath Works, 426-432 3d avenue, Brooklyn, N. Y.; Stockhoff Supply Co., 432 S. 12th street, St. Louis, Mo., etc. Ransome & Smith Co., 11 Broadway, N. Y., may also be considered in this connection.

SEWER TRENCHING MACHINERY.

Can you give us any information in regard to machinery for digging trenches for laying sewers? We have about 15,000 lineal feet of trench in the finest kind of dirt to handle as there are no stones in it whatever. *The Briggs Real Estate Company, Peoria, Ill.*

Reference may be made to the article on "Modern Machinery in Sewer Building" on page 189 of the March number, describing the machine made by the Potter Manufacturing Company, Indianapolis, Ind. The Carson Trench Machine Company, of Boston, with western office at 22 South Water street, Cleveland, Ohio, also makes a good machine. Machines can probably be either leased or bought.

CATALOGUES OF MACHINERY FOR ENGINEERS.

Will you be kind enough to send me any catalogues you may have that will be of assistance in considering the subject of machinery needed by civil engineers in the construction of public works? *John S. Hegeman, Bethlehem, Pa.*

The editor has a file of such catalogues which is freely open to inspection by visitors to the office, but duplicates can not be sent out. Our correspondent is referred to the business directory in our advertising pages which contains a representative list of manufacturers of machinery used in the construction of public works, all of whom will furnish the catalogues desired upon application.

STRENGTHENING A CHIMNEY.

We have a chimney with three flues entering below the ground surface, those on the north and south sides when the chimney was built and that on the east side about two years ago. Last week I noticed the chimney leaning to the east, and a slight crack is now showing along the bottom of the west side. Observation shows it is going a fraction each day. The soil is good hard red clay, which is dry and hot under and around the stack from the temperature of the gases at the bottom, which is about 1,500 degrees. What has been done in similar cases? *Colin S. Cameron, Sarnia, Ont.*

Apparently the concentration of the chimney's weight on the pillars left at the two eastern corners when the flue opening was made on the eastern side, has finally had the effect of compressing the foundation or the brick work enough to cause the chimney to tip in that direction, and now that the weight is thrown more in that direction, the effect is likely to be greater. A cage, such as is described in an answer to a question by the same correspondent on "Moving Tall Chimneys," on page 162, September, 1901, can be applied and the weight taken off the present foundation, by spreading it over a sufficient area of the surrounding earth, through the shores. When the chimney is wholly supported, the foundation or the piers can be replaced and the chimney straightened. There are also methods of introducing supports in smaller units, obviating the necessity of the supporting jacket and shores, but their application would probably require a longer time. An engineer of experience or a contractor who has done the same work elsewhere should have charge of the work, the necessity for which seems to be immediate.

CONSTRUCTION AND MAINTENANCE OF JAIL.

Can you give me any information as to where I can obain any sort of literature on jail building or maintenance? *Engineer, ——, Peru, S. A.*

Examination of the following books and other literature is suggested:

Palliser's "Court Houses, Village, Town and City Halls, Jails, etc." (82); catalogues of makers of steel cells and steel work for jails; reports of state officials regarding methods of construction and maintenance of penitentiaries, such as that at Jeffersonville, Ind.; the first report of the engineer department under the military governor of Cuba, recently issued; descriptions of application of Ransome system of concrete and steel construction to jails at Mineola, N. Y., Chelsea, Mass., Charlestown navy yard, to be obtained of E. L. Ransome, New York, or the Aberthaw Construction Co., Boston, Mass. There have been several reports upon investigations of methods of maintenance of jails and of plans for conducting them, definite reference to which can not be made at this time. Can our readers aid by contributing name and date of any such reports?

DUTIES OF MAYORS OF CITIES.

The question for the inter-class debate in Upper Iowa University is regarding the concentration of all executive and administrative power in the mayor in cities of 40,000 population or more. Any references to literature upon the subject will be very acceptable. *L. E. Mills, Fayette, Iowa.*

This is rather a large question for such a debate, and one which is so largely dependent for its solution upon conditions of law, custom and character of people, that only a general idea can be gained from such a dis-

cussion as is here proposed. In the daily and weekly papers of such cities as New York, Chicago, Indianapolis, St. Louis, etc., where such propositions have been under discussion, will be found much upon the subject of more or less value. Most of this appeared some years ago, and the more valuable contributions found their way into weeklies and monthlies, and can be found by reference to Poole's index of periodicals. Another source of information about such articles is Brooks's "Bibliography of Municipal Problems and City Conditions" ($1.50). An article in the proceedings of the American Society of Municipal Improvements for 1900 ($1) on "City Government" gives the details of the methods in a number of the larger cities. It covers about 140 pages.

BOOK ON RIPARIAN RIGHTS.

I understand there is a book published treating of riparian rights or court decisions on riparian rights. Can you give me the name of such a book?

I. H. Andrews, Reed City, Mich.

Gould's "Waters and Riparian Rights" ($6) is perhaps the book desired.

MANUFACTURERS OF PIPE FITTINGS.

We want a bent pipe fitting made in polished or lacquered iron pipe in lots of 1,000 or more, and would ask your kind offices in getting into communication with a manufacturer in this line.

Irby & Gilliland, Memphis, Tenn.

Almost any manufacturer of plumbers' supplies can make the apparatus desired. Among those nearest Memphis the names of the following are at hand, who may be able to accept the orders: Bell-Armistead Mfg. Co., Vincennes, Ind.; Crane Co., 10 N. Jefferson street, Chicago; Crane-Hawley Co., 220 E. 9th street, Cincinnati, O.; Kuhns Bros., Dayton, O.; Kupferle Bros. Mfg. Co., 600 N. 2d street, St. Louis, Mo.; John H. McGowan Co., Cincinnati, O.; E. A. Stimson & Co., Dayton, O. There are many others, and some of our readers may be able to give valuable information for our correspondent.

DIRECTORIES OF ELECTRIC AND GAS LIGHTING PLANTS.

Will you kindly advise the writer whether there are directories giving the electric lighting and gas plants in the eastern section of the United States?

L. A. Keegan, New York City.

Can you put us on the track of any directory or book which gives the names of electric light and gas plants in the different towns?

The New England Newspaper Bureau, Boston, Mass.

Powers' "Central Station Directory and Buyers' Manual" is a quarterly publication, issued at $4 a year, containing a list of the electric lighting central stations in the United States, Canada and Mexico, with a number of items regarding them, in condensed form. Brown's "Directory of American Gas Companies" ($5) gives similar information and statistics regarding the gas lighting companies of the United States and Canada, as well as other useful information regarding the organizations in the gas field.

BOOKS ON APPLICATIONS OF ELECTRICITY.

Having studied the theory of electricity as taught in courses of civil engineering ten years ago, I desire some concise work that deals with the practical application to the designing of an electric lighting system for an industrial plant employing say 4,000 people. I also want a work to give me a fair working knowledge of the uses and design of the various generators, motors and dynamos and the methods of carrying the currents, wiring, etc.

E. S. Phelps, Boston, Mass.

The following books are suggested for examination. They can doubtless be seen in public, college, or society libraries in Boston, or at book stores making a specialty of technical literature. Only by examination of the books can one determine their application to his special purpose; Atkinson's "Elements of Electric Lighting" ($1.50); Badt's "Incandescent Wiring Handbook" ($1); Crocker's "Electric Lighting" ($3); Gordon's "Practical Treatise on Electric Lighting" ($4.50); Maycock's "Electric Wiring Tables" ($1); Urquhart's "Electric Light Fitting" ($2); Cushing's "Standard Wiring for Electric Light and Power" ($1); Hering's "Universal Wiring Computer" ($1); Foster's "Electrical Engineer's Pocketbook" ($5); Houston & Kennelly's "Electric Incandescent Lighting" ($1) and "Electric Arc Lighting" ($1).

SIZE OF SUPPLY MAINS FOR WATER SYSTEM.

Our consumption is now about 1,200,000 gallons a day, furnished from springs accumulated in two reservoirs, whose conduits of 8 inches diameter join into an 8-inch conduit leading to a storage reservoir on a hill about two feet below the outlet of the nearer of the collecting reservoirs, and over 100 feet below the other, and nearly 200 feet above the town. A loop of 8-inch pipe is run round the hill, so that if desired water can run to the town without passing to the storage reservoir. This 8-inch pipe enlarges to 10-inch, and to 12-inch in the streets in town. When the gates are open round the loop, not a drop of water reaches the storage reservoir during the daytime, even if the collecting reservoirs are overflowing. What is the explanation of the circumstance? Is the 8-inch conduit too small for the daily consumption, and could a fire pressure of 80 pounds be maintained in the daytime?

W. T. Smith, Water Commissioner, DuBois, Pa.

The letter and the sketch accompanying it do not contain sufficient data to locate the trouble exactly. The profiles of the

pipe lines and the relative elevations of the summits, as well as their distances apart, must be known exactly. An inspection of mud valves and air valves is also advisable. With full data a theoretical solution of the problem is not a difficult matter, but the actual conditions in existence may materially modify the conclusions. Deposits or air in the pipes or unnecessary summits may account for the apparent lack of supply, or it may be due to the main being too small for the fall between the ruling gradients between summits in the pipe line. Eighty pounds pressure with fire streams running can hardly be obtained through a main with the sizes of pipe named and probable length, from a storage reservoir less than 200 feet above the streets of the town. Competent engineering advice, based on a personal inspection, will be worth all it is likely to cost.

INSTRUCTION IN MUNICIPAL ENGINEERING.

Will you kindly inform me of any college or school of engineering where a South American young man can take a course in municipal engineering, including the subjects of arithmetic, algebra, geometry, trigonometry, mechanics and physics, mechanical drawing and mapping, surveying, strength of materials, water supply, storage and distribution, drainage, sewerage and sewage disposal, streets and pavements, street railways, public lighting, municipal organization, assessments and franchises? *O. A. Acevedo,*
Brooklyn, N. Y.

Engineering colleges which cover the ground here laid out require a large part of the first three subjects mentioned for entrance to the institution, but in many of them, especially the smaller colleges where there is more direct supervision of the work of students, it is possible to arrange for opportunities to make up any deficiencies in the conditions for entrance. Among the larger schools in which instruction in most of the branches named can be obtained, may be mentioned the Lawrence Scientific School of Harvard University, Cambridge, Mass.; Cornell University, Ithaca, N. Y.; the University of Vermont, Burlington, Vt.; the University of Michigan, Ann Arbor, Mich.; the University of Wisconsin, Madison, Wis.; the University of Illinois, Champaign, Ill.; Purdue University, Lafayette, Ind.; Lehigh University, South Bethlehem, Pa. Smaller schools, in which a special course such as outlined can be pursued, are Vanderbilt University, Nashville, Tenn.; Washington University, St. Louis, Mo.; Lafayette College, Easton, Pa.; and Union University, Schenectady, N. Y. There are others of which catalogues are not at hand.

Students whose other duties prevent putting all their time upon their studies find the guidance of good correspondence schools very valuable, though it can not take the place of personal contact with experienced teachers. The International Correspondence Schools, Scranton, Pa., are the oldest schools of this kind and their work is uniformly satisfactory to students who pursue their studies faithfully. In some cases the work with such schools is taken in preparation for further work in college or university.

CONCRETE. *

By S. B. Newberry, Sandusky, O.

The modern use of concrete in place of stone under the most trying conditions, such as the construction of great breakwaters exposed to the action of heavy waves, also in bridges and architectural work, would have been impossible with any other binding material than Portland cement. The excellence of Portland cement is due to the exact proportions of the clay and lime used in its manufacture; these proportions can only be made uniform and correct by the use of an artificial mixture. Slag cements and natural cements, formerly used in Europe, have been replaced almost entirely by Portland.

The other materials of concrete, the sand, gravel and broken stone, constitute the "aggregate." The purpose in view in combining these is to produce the greatest possible density. This is accomplished by so adjusting the proportions of the finer material as to fill, as completely as possible, the voids in the coarser material. The minimum of voids is to be found in a mixture which consists of particles of a great variety of sizes from the smallest to the coarsest. Screening is therefore undesirable, unless, by separating and remixing in different proportions, the voids can be reduced. This is not generally practicable or necessary.

The determination of the percentage of voids in the gravel or broken stone to be used is of the greatest importance and may lead to great economy in cost of the resulting concrete. Determinations by the writer of the voids in some available

*From a paper before the Indiana Engineers' Society.

concrete materials gave the following results:

Sandusky Bay Sand, not screened, 32.3 per cent.

Gravel, ¼ to 1-20-inch, 35.9 per cent.

Broken Stone, from Marblehead, O., 1 to 2 inches, 47 per cent.

Mr. William Hall, in the discussion of Rafter's paper on theory of concrete, read before the Society of Civil Engineers, December, 1899, gives the voids in materials used in lock and dam construction in Kentucky as follows:

Sand, 31 per cent.

Gravel, passing 1½-inch and freed from sand by a fine screen, 35 per cent.

Stone, 2½-inch, 48 per cent.

The simplest method of determining the voids in gravel or broken stone is to have a metal box made of exactly one cu. ft. capacity. This is filled with the material to be tested, well shaken down and struck off level, and weighed. In the case of broken stone, which is more or less porous, the material must previously be saturated with water and well drained. Water is now poured in at one corner until it rises even with the surface, and the weight is again taken. The difference is the weight of water filling the voids of the material. Now, one cu. ft. of water weighs 62 4-10 lbs., and from the weight of water found the percentage of voids can be simply calculated.

For example, in one experiment the box and broken stone weighed 88 lbs. After filling the spaces with water, the total weight was 117½ lbs., a difference of 29½ lbs. The percentage of voids was therefore 29½x100÷62.4 equals 47.3 per cent.

In the case of sand this method will not answer, as it is difficult to completely fill the voids of the sand by adding water. The voids can, however, be readily calculated from the weight of a cu. ft. and the specific gravity. The specific gravity of quartz sand is about 2.65. A cu. ft. of sand, free from voids, would, therefore, weigh 2.65x64 equals 165.4 pounds. The weight of a cu. ft. of sand well shaken down was, however, found to be only 112 pounds, a difference of 53.4 pounds. The proportion of voids was, therefore, 53.4x100÷165.4 equals 32.3 per cent.

There is a great difference of opinion as to the comparative merits of gravel and broken stone for concrete. In itself the stone offers greater resistance to pressure, having less tendency to slide and shift. On the other hand, gravel shows very much less voids, and requires less mortar to give a dense concrete. It is also generally far cheaper than broken stone. There is no doubt that good, clean gravel, bound together with suitable proportion of Portland cement mortar, makes a magnificent concrete, suitable for any possible purpose. This is of importance to engineers located in the northern part of Indiana, where stone is scarce, but where immense beds of gravel, equal to any in the world, are found in great abundance. Mr. Webster, chief engr. of the city of Philadelphia, assured the writer that his tests had shown gravel to be superior to stone, and that he would always use gravel if he could obtain it at equal cost.

Having determined the voids in the sand, gravel and broken stone which we propose to use, the next problem is to calculate the proportions in which these materials shall be mixed for the purpose in view. At first glance it might be supposed that the larger proportion of cement the concrete contains, the stronger it will be. This is by no means the case, as the following table, taken from a paper by Dyckerhoff before the German Portland Cement Manufacturers' Association, clearly shows:

Cubes 2½ inches square, at 28 days.

Proportions by Measure.			Strength under Compression.
Portland Cement.	Sand.	Gravel.	Lbs. per sq. in.
1	2	.....	2,125
1	2	3	2,747
1	2	5	2,387
1	....	5	978
1	3	.....	1,383
1	3	5	1,682
1	3	6½	1,515
1	4	.....	1,053
1	4	5	1,273
1	4	8½	1,204

These figures show that mixtures of cement and sand are strengthened and not weakened, by the addition of a suitable quantity of gravel. It will be noticed that the mixture, cement 1, sand 2, gravel 5, is actually stronger than cement 1, sand 2, without gravel. The same is shown in the mixtures one to 3 and one to 4.

The determination of the voids in the sand to be used is really less important than in the stone or gravel, since the proper adjustment of the coarser materials greatly affects the strength and density of the resulting concrete, and should be correct, whatever proportion of cement it may be decided to use. The amount of cement will depend on the strength desired and considerations of economy. The voids in natural sand are also fairly constant, and may generally be assumed to be from 33 to 35 per cent. in a mixed and fairly coarse sand, and from 35 to 38 per cent. in fine sand of more uniform grain.

Having determined the voids in the

sand and gravel or stone, let us next inquire how we shall calculate the proportions in which these materials are to be used. Mr. Rafter, in the paper referred to above, recommends expressing the composition of the concrete in terms of the percentage which the mortar forms of the total volume of stone. His experiments were made with cement and sand mortars, one to one, 2, 3, 4 and 5, mixed with stone in the proportions of 33 per cent. mortar and 40 per cent. mortar to 100 per cent. stone. The voids in the stone are not stated, but were probably not less than 48 per cent. The resulting concretes were therefore quite porous and by no means of maximum density. The discussion of Mr. Rafter's paper called out expressions of opinion from many eminent engineers and afforded much valuable information. Mr. William B. Fuller points out that there is one proportion, and only one, in which a given sand and stone can be mixed and give the minimum of voids, and claims that this is the proportion in which they should always be mixed, whether a rich or poor concrete is required. Mr. Fuller's rule is: "Mix the sand and stone (or gravel) in a definite fixed quantity as determined by experiment for the material in use, and then add cement as economy dictates, possibly up to 10 per cent. in excess of the voids in the combined material."

With this recommendation the writer heartily agrees, believing it to be in accord with the dictates of common sense and the results of the best practice.

As an example, let us calculate the proportions called for in case of the materials mentioned above: Sand with 32.3 per cent. voids and gravel with 35.9 per cent. To fill the voids in the gravel with sand we shall require 35.9 volumes of sand to 100 volumes of gravel or one to 2.8. To fill the voids in the sand with cement we shall require 32.3 per cent. of 35.9 or 11.6 parts. The theoretical proportions will then be cement, 11.6; sand, 35.9; gravel, 100, or one to 3.1 to 8.6. On account of the impossibility of securing a perfect mixture it may be best to slightly increase the proportion of sand to gravel. I would recommend adhering, however, closely to the calculated proportion, since it must be remembered that the cement and sand mixture is much weaker than the concrete as a whole.

A similar calculation will show that with the same sand and broken stone showing 47 per cent. voids, the theoretical proportions will be one of sand to 2.13 of stone, and of cement, sand and stone one to 3.1 to 6.5.

As to the actual proportion of cement to be used; this must be decided upon economical considerations, and with a view to the purpose intended. Sand, gravel and stone are cheap, while cement is relatively expensive, though if prices continue to fall as they have during the past year cement will soon be the cheapest material in the whole group. The more cement, up to a certain point, the stronger the mixture will be. The gain in strength obtained by using more cement than the amount actually required to fill the voids is, however, slight in comparison with the increased cost. I agree with Mr. Fuller that the use of 10 per cent. more cement than is required to fill the voids in the combined material may be regarded as a practical maximum. This is unnecessarily good for ordinary purposes, and will be required only for water-tight work or for the foundations of engines and heavy machinery, in which the best result must be secured without regard to cost. Very good concretes may be made in the following proportions, varied slightly according to the voids in the coarser materials:

Cement 1, sand 4, gravel 11.
Cement 1, sand 5, gravel 14.
Cement 1, sand 4, stone 9.
Cement 1, sand 5, stone 12½.

If well mixed these concretes will be found to answer admirably for building or pavement foundations or the filling of piers and abutments.

Returning to our calculation of the proportions of a theoretically perfect concrete we found that the mixtures:

Cement 1, sand 3.1, gravel 8.6,
Cement 1, sand 3.1, stone 6.5,

fulfill the conditions that the voids in the mixed sand and coarse material shall be completely filled with cement. These may seem like poor concretes, but in fact they are extremely good and will show a crushing strength of over 2,000 pounds per square inch after twenty-eight days' hardening. The secret of their quality is, however, the correctness of the proportions, and a small variation in the relative amounts of sand and gravel or stone will convert them into poor and inferior concretes, even though the proportion of cement be not changed. To improve the strength still further, perhaps even to 4,000 to 5,000 pounds per square inch, the cement only requires to be increased. Simultaneous increase of the sand would defeat the purpose in view, and would weaken the concrete perhaps as much as increase of cement would strengthen it. Remember that a properly proportioned concrete, 1 to 3 to 8½, is stronger than a cement and sand mixture 1 to 3. One barrel of cement in judicious admixture with sand and grav-

el is, therefore, as good as three barrels with sand only. I need say no more to make clear the necessity of careful and scientific methods in the specification of concrete mixtures.

Now we come to another important question, that of the proportion of water to be used. Here, again, the principle of maximum density should guide us, and such an amount of water used as will cause the mixture, with the amount of tamping employed, to pack together into the smallest possible bulk. In laboratory tests we find this condition attained by the use of very little water; only enough, in fact, to give the mixture the consistency of moist garden earth. The amount of tamping or pounding which can be given to laboratory specimens, however, is vastly greater in proportion to their bulk than can be given in work on a large scale. For this reason, probably, engineers have found that the use of more water, at least enough to make the mass decidedly plastic gives better results in practice. A striking proof of this is found in experiments by the engineers of the C., M. & St. P. railway, described in a paper by Hitz in the Engineering News, January, 1901. Three-foot cubes of cement, gravel and stone were prepared, using water to the amount of 44 per cent. and 82 per cent. of the volume of cement, respectively. The first mixture was merely damp, and was compacted in the box by thorough tamping. The second mixture was liquid, and was poured into the mould without tamping. After thirty days' hardening the wet cube was found to be 9.7 per cent., (340 lbs.), heavier than the dry, and was smooth and dense on the surface, while the dry cube was rough and porous. On splitting the blocks the wet cube proved to be much harder, and most of the stones were broken along the line of fracture. The dry block, on the other hand, gave an irregular break, most of the stones remaining whole, and the mass showed distinct layers corresponding to the different batches of material tamped into the mold. In Rafter's experiments with 1-ft. cubes, on the other hand, the blocks made rather dry showed slightly greater strength than those made plastic or wet. It is therefore evident that high density may be obtained with damp mixtures by strong tamping, or with wet mixtures with little or no tamping. In the discussion following Rafter's paper, several prominent engineers stated that fairly wet mixtures had given them the best results, owing to the impossibility of securing conscientious and uniform tamping in work on a large scale. Mr. Herman Conrow found the cost of wet concrete, laid in place, $4.13 per yard, and of dry concrete of the same composition, $5.12 per yard. The use of a liberal proportion of water thus effected a saving of 24 per cent.

As to method of mixing, the speakers in the discussion above referred to were divided on the question of hand or machine mixing. The writer is strongly in favor of the use of a suitable concrete-mixer, both for the sake of quality of work and economy of labor, and prefers a machine of the pug-mill type, consisting of trough with revolving blades.

The question of the yield of concrete from various mixtures is one of importance to engineers. Unfortunately the necessary data for the establishment of a rule or formula are not yet available. Mr. Rafter's figures show that the volume of concretes made of stone with 33 per cent. mortar was 9 to 10 per cent. less than the volume of stone used; with 40 per cent. mortar the shrinkage was about 6 to 8 per cent. In these mixtures the amount of mortar was insufficient to completely fill the voids in the stone.

Dyckerhoff gives the following results, by volume, using gravel with 35 per cent. voids:

Cement 100, sand 200, gravel 400, concrete 440
Cement 100, sand 300, gravel 600, concrete 665
Cement 100, sand 400, gravel 800, concrete 885

In these mixtures an excess of sand is used over that necessary to fill the voids in the gravel. Accurate figures of volumes of correctly calculated concretes are unfortunately lacking. It will probably be found, however, that in mixtures in which the sand just fills the voids in the gravel or stone, with cement in the common proportions of ¼, 1-3 or ½ the amount of sand, the volume of compacted concrete will be about equal to that of the stone or gravel taken.

In conclusion, the necessary conditions for obtaining the best results in concrete work may be briefly stated as follows:

1. Choice of strong, clean materials of such character that will give a mixture of medium density.

2. Adjustment of the proportions of the materials in such a manner as to give the lowest possible amount of voids.

3. Use of the best American Portland cement in the proportion necessary to give the required strength.

4. Use of enough water to make the mixture at least thoroughly plastic.

5. Intimate mixture of the materials, preferably by means of a concrete mixing machine.

6. Thorough compacting of the mass by ramming.

7. Uninterrupted filling of the forms, by night and day work, if necessary, to avoid seams or partings in the mass.

8. Protection of the work from freezing, by use of warm materials, fires, or covering with straw, until thoroughly set.

9. Keeping the work well moistened, by occasional sprinkling, for at least thirty days after laying.

MUNICIPAL MATTERS IN COURT.

[Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.]

Acceptance of Plat—What is a reasonable time for acceptance of street or a plat depends on the situation and circumstances. Sarvis vs. Caster et al., 89 N. W. Rep. (Iowa) 84.

Rules for Assessment—The legislature has power to distribute the cost of a local improvement on property on the street where the improvement is made, either on the basis of a specified sum per linear foot, or according to the frontage of lots. People ex rel. Scott vs. Pitt et al., 62 N. E. Rep. (N. Y.) 662.

Title to Soil in Highway—A street railway company owns no interest in the soil of the highways over which its road passes which may be taxed as real estate, but the inherent value of its property above the cost of reproducing the material constituents of its line arises from its franchise, which is subject only to state and not municipal taxation. Mayor, etc., of City of Newark vs. State Board of Taxation et al., 51 At. Rep. (N. J.) 67

Interest on Claim of Contractor—A claim against a city to recover for work done under a contract which did not fix the amount of work or material only bears interest from the date of a referee's report as to the amount under the code, which directs that the judgment shall include interest on the amount thereof from the time the verdict was rendered or the report or decision made. Sweeny et al. vs. City of New York, 74 N. Y. Supp. 549.

Alien Labor Clause—Where a contract for street improvement contained a clause that the contractor would not employ any persons other than citizens of the United States, and no such requirement was in any ordinance or in the advertisement for bids, and it was not shown that the clause was known to the bidders or in any way affected the bidding, it was no defense in proceedings to collect a special assessment against an owner. Hamilton vs. People ex rel. Raymond, 62 N. E. Rep. (Ill.) 533.

Responsibility of Contractor—Where one having a contract for the excavation of a trench along the side of a street railway track bridged the trench at crosswalks, and at night protected the trench only by ropes and lights, which were stretched on the sidewalk side of the trench, it could not be said as a matter of law that the contractor had discharged his entire duty in covering the trench, and leaving the safety of passengers desiring to alight to depend on the accuracy of the motorman's judgment in stopping the car opposite the bridge. Wolf vs. Third-ave. R. Co., et al., 74 N. Y. Supp. 336.

Municipal Lighting—A statute authorizing cities to incur indebtedness to pay the cost of any municipal improvements, authorizes a city to incur an indebtedness for improvements for lighting a city, though one section, authorizing the making of certain specified improvements and "other municipal improvements," does not designate improvements for municipal lighting, as the latter section does not limit the power given in the first section to the improvements designated in the second section, and others which are ejusdem generis. Hammond vs. City of San Leandro et al., 67 Pac. Rep. (Cal.) 692.

An Elastic Statute—An Arkansas statute authorizing any city of the first or second class or any incorporated town to assess all real property within such city, or any district thereof, for grading or otherwise improving streets and alleys, constructing sewers, or making any local improvements of a public nature, authorizes an assessment for park improvements, as the language is broad enough to include any class of improvements which will enhance the value of the real estate in the city or district assessed therefor. Matthews et al. vs. Kimball et al., 66 S. W. Rep. (Ark.) 651.

Paving—Liability of Property Owner—A city charter prohibited special assessments for street improvements against abutting property owners who had formerly made any improvement of a similar kind. The owner on a street paved with cedar blocks and curbed with wood signed a petition requesting its repaving with cedar blocks and the construction of a stone curb; but the city paved the streets with macadam and curbed it with

stone, after the circulation of a new petition, which was not signed by the property owner. Held, that the original petition and the paving and the curbing of the street did not creare a contract between the city and the property owner, requiring the latter to pay his proportion of the expenses. Winnebago Furniture Mfg. Co. vs. Fond Du Lac County et al., 88 N. W. Rep. (Wis.) 1018.

Monopoly in Material—In proceedings to collect a special assessment for street improvements defendant offered to show that the successful bidder controlled all the "slag" in the market and dictated the price of such material at the time of the bidding, and refused to sell to other contractors unless they would agree not to oppose the using of slag on the streets, on which condition alone it was possible for other contractors to bid on slag paving, and that the bidder was the only bidder on this improvement. Held, that such facts were no defense to the collection of an assessment for the work performed; such testimony not tending to show that the amount paid was more than a fair contract price, nor disclosing when the owner received knowledge of the facts. Givins vs. People ex rel. Raymond, 62 N. E. Rep. (Ill.), 534.

City's Liability for Acts of Officers—In an action against a city for excavating a street without following the statute as to the establishment of grades, plaintiff's evidence showed not only that the street commissioner did the work according to a grade fixed by a surveyor employed by the city under the direction of the chairman of the committee on streets but that the city paid the commissioner, the surveyor and others during the work; that the street commissioner made monthly reports to the council; and that grade stakes were set with the aid of the chairman and other members of the street committee and of the council, and that nearly all the members of the council saw the work while it was being done. Held, sufficient to establish defendant's connection with the wrong done as matter of law, notwithstanding its evidence that the acts were done in the first instance without express authority. Brown vs. city of Webster City, 88 N. W. Rep. (Iowa), 1,071.

CURRENT INFORMATION.

Reports on St. Louis Water Supply.

The commission of engineers appointed to consider the improvement of the water supply of St. Louis has made its reports, which are on file, but have not yet been published. A majority report was made by Benezette Williams and George Y. Wisner, favoring an entirely new supply from the Meramec river, which would require neither pumping nor purification. A minority report was made by Allen Hazen which practically recommends the coagulation and further sedimentation and filtration of the effluent from the present sedimentation basins, modified to suit the new conditions. Mr. Hazen presents a corroborative opinion written by George W. Fuller. The majority presents a supplementary report answering the objections made to their proposition by Mr. Hazen, and reiterating its objections to the filtration scheme. The first two gentlemen are engineers of national reputation in connection with problems concerning water and its supply, whose experience has been largely with the use of water in its natural state, and Mr. Hazen is equally well known as an authority upon the purification of water. The reports reflect the tendencies of thought of their authors, the majority coinciding with what has been the general opinion among those familiar with Mississippi and especially Missouri river water, that special experiments must be made to determine the best methods of treating the river water and the cost of the same, while Mr. Hazen thinks that the experience with Ohio river water at Pittsburg, Cincinnati and Louisville, and with Mississippi river water at New Orleans demonstrates the sufficiency of the methods he proposes, and gives ample data for reliable estimates of cost of construction and operation.

Regarding the character of the Mississippi river water to be treated, the majority presents among the data the following tables and statements: The first table compares the amounts of suspended solids in samples taken from the Missouri river water, from the intake tower where the upper Mississippi forms a large proportion of the flow, from the chamber at the outlet of the sedimentation basins and from the tap in the chemist's office after flow through distribution pipes.

—Suspended Solids in Water at Chain of Rocks, Jan., 1900, to June, 1901—
(Parts per 1,000,000.)

Month.	Raw water. Missouri shore.	Raw water. Intake tower.	Subsided water. Outlet chamber.	Subsided water. Tap in chemist's office.
January	235	355	82	65
February	370	385	86	56
March	1,925	1,354	290	218
April	2,045	1,144	223	216
May	1,514	1,027	153	132
June	2,660	2,542	194	106
July	2,432	2,483	157	69
August	1,098	1,008	158	99
September ...	1,154	1,096	130	95
October	2,110	1,088	280	200
November	....	....	...	...
December ...	223	193	70	71
Average ...	1,425	1,152	165	121

The evidence shows that Mississippi river water at St. Louis, on the Missouri side, carries not less than 1,500 parts per 1,000,000, and at the inlet 1,200 parts for a normal year. The subsidence, for sixty hours, ranges from 65 per cent. for months of least sediment to 94 per cent. for months of greatest. The average yearly efficiency is about 85 per cent. For a thirty-five-hour period the average efficiency was 75 per cent.

The following table compares St. Louis river water with the water supplies of other cities in regard to the amount of suspended matter in the water, the last column giving the percentage of sediment in each water supply, assuming the sediment at St. Louis as 100 per cent.

	Parts per 1,000,000.	Per Cent.
Merrimac river, Lawrence....	10	0.8
Hudson river, Albany	15	1¼
Allegheny river, Pittsburg	50	4 1-6
Potomac river, Washington..	80	6 2-3
Ohio river, Cincinnati	230	19
Ohio river, Louisville	350	29
Mississippi river, New Orleans	650	54
Mississippi river, St. Louis intake	1,200	100

The conclusions are then stated that (1) there are no known data to fix the proportion which capacities of plain settling basins should bear to amount of water to secure the most economical results in the operation of a filter plant. (2) As some basis of estimate is required, we have assumed what we consider the minimum capacity admissible, viz.: one with which the minimum time of subsidence will not be less than twenty-four hours, the average time being thirty-six hours. (3) With such capacity of basins the subsided water will carry an average of suspended matter somewhere between 250 and 300 parts per 1,000,000. (4) With an average subsidence of thirty-six hours there will be periods of several days during which the effluent water from the basins will contain more than 750 parts per 1,000,000.

The majority report calls attention to the fact that while there is no direct evidence that disease germs pass filters, the fact that some bacteria do pass suggests the possibility that a like proportion of disease germs in the raw water will be found in the filtered water. The increase in sulphate of lime due to the coagulant used is cited as an objection from the point of view of the boiler owner, on account of the increase in incrustation, and in corrosion of metal in general. Mr. Hazen meets the objections of this sort and those regarding operation as follows:

As to physical difficulties in operating the plant successfully, I believe there are none that cannot be successfully met. True, the water at St. Louis is difficult to treat, and will require more thorough methods than are needed elsewhere. The plant as designed is far more complete than any plant ever constructed. To some extent the work is novel and experimental, but the important matters are well understood from experiments with similar waters. The estimates are based on treating water as bad or worse than records show St. Louis water to be. If unexpected difficulty is developed, the margin between my estimate and that of the majority will cover any contingencies that may arise.

I believe the hygienic character of the purified water will be satisfactory. True, the river carries very large numbers of bacteria, washed by rains from the rich soil of the watershed, but so far as there is danger to health in the present water, it will be reduced by filtration to an almost inappreciable amount.

If found desirable, the supply can be drawn from the Missouri river by gravity to the chain of rocks works. A tunnel four or five miles long, with 300,000,000 gallons capacity would cost about $1,500,000.

I believe the filtered river water will be reasonably satisfactory for mechanical uses, and that there will be no seriously objectionable results from the use of a coagulant. The water cannot be satisfactorily treated without a coagulant. The alkalinity is ample to neutralize the coagulant required. The alkalinity at St. Louis is much greater than that of the Ohio river and there will be less danger of the production of conditions that will corrode pipes or otherwise be injurious than at Ohio river cities. The raw water contains practically no free carbonic acid and is saturated with oxygen.

In soap-consuming power the filtered river water will not differ materially from the Meramec water. It will differ in that some of the lime will be in the form of sulphate instead of carbonate. The sulphate is more objectionable in boilers. I believe the sulphate of lime in the filtered water is very largely overestimated in the majority report. I had not supposed and do not believe that this matter will give serious trouble.

When we saw the Meramec spring the water was perfectly clear, but it is sometimes turbid. We have no information as

to how turbid it gets or how long the turbidity lasts. The water from the impounding reservoir will hardly have a turbidity less than that due to from three to twenty parts of suspended matter per 1,000,000 gallons. This will be so fine as not to be removed in conduits and reservoirs. Filters will give an entirely clear effluent.

In sanitary quality I believe the purified river water fully equal to the gravity supply. The water of Meramec spring is largely surface water from the Dry Fork, coming through caverns without long storage of filtration.

In physical appearance the filtered water will be best. For mechanical purposes it will be as good. For boilers it will be less desirable, but I do not believe the difference will be great. All things considered, I believe the quality of the purified water will be at least equal to water from Meramec spring and river.

Mr. Fuller supports Mr. Hazen, making statements very similar to the preceding.

The influence of the point of view and of the nature of previous experience is shown in the large differences in the estimates of cost of the two plans proposed as made in the two reports. From the report of the majority the following figures are selected regarding the cost of supply works, the cost of the system for distributing the water through the city being carefully separated and omitted fro the consideration.

The comparisons of cost of the new plants are based on a term of 55 years and include cost of construction and certain renewals and do not take into account the value of existing works. For purification plant the total cost of works is estimated as follows:

Total estimated cost for structures and machinery	$6,011,700
New buildings and miscellaneous structures	1,607,500
Renewal of buildings and miscellaneous structures	691,000
Settling basins	1,416,000
Clear water reservoirs	880,000
Improvement of Compton Hill reservoir	308,000
New inlet tower, tunnel and appurtenances	333,700
New conduit	661,500
Filter plant	3,643,000
	$15,552,400
Force mains in excess of gravity system	2,300,000
Total (not including main renewals)	$17,852,400

This practically duplicates the present plant and gives an average daily capacity of 184,000,000 gallons.

Estimates for renewals assume that the filter plant will have a life of 40 years; engines, boilers and foundations, 30; open settling basins, 100; conduit, and Baden, 100; buildings, 60; closed reservoirs and underground tunnels, permanent. On this basis the total renewal fund for 55 years would amount to $5,622,583.

The total cost for fifty-five years is therefore $23,474,983, or, for the 2,479,751 million gallons estimated as the supply for that time, $9.46 per million.

The cost of operating a filter plant is uncertain for want of sufficient knowledge of the requirements. For the purpose of this report we estimate 3.5 grains of sulphate of alumina per gallon, or 500 lbs. per 1,000,000 gallons, at 1¼ cts. per lb., $6.25; labor, repairs, etc., $2.25; minimum cost of supply in the past, $13.65; total, $22.15.

Assuming $20 as the cost of operation, the total cost of water is $29.46 per million. The average cost of supply for the past sixteen years has been $14.74.

Mr. Hazen criticises the estimate as not in accord with his judgment of the probabilities. He states that the new works contemplated have much greater capacity, 393,000,000 for intakes, 360,000,000 for pumps at Chain of Rocks, 300,000,000 for filter basins, 350,000,000 conduit, 390,000,000 pumps at Baden, at least a 300,000,000 basis, which can more safely be depended upon to meet the assumed average of 184,000,000 gallons per day than the gravity supply, for he thinks that in 1950 the capacity of the aqueduct, moderately dirty, will be reached during the months of maximum consumption and the average daily rate of supply to be depended upon will be 160,000,000 instead of 184,000,000 gallons. He also very propefly assumes forty years, the life of the river plant, as the period on which discounts are to be computed for it. On this basis he computes the cost of the river project as follows:

The cost of the river project, revised, is as follows:

New works required, and depreciation charges up to and including 1945, discounted to Jan. 1, 1906	$10,670,000
Approximate discounted value of operating expenses for the years 1906 to 1945, inclusive, at $20 per 1,000,000 gallons, Jan. 1, 1906	16,060,000
Operating expenses after 1945, 160,000,000 gallons per day, at $20 per 1,000,000 gallons, $1,162,000 per annum; capitalized at 3¼ per cent, $35,960,000; discounted for forty years	10,006,000
Depreciation charges after 1945, $158,577 per annum; capitalized at 3¼ per cent., $4,879,000; discounted for forty years	1,358,000
Total cost of building and operating river works for ever, with an ultimate capacity of 160,000,000 gallons per day, discounted to Jan. 1, 1906	$38,094,000

Deduct sale of Bissell's Point property and value of pure water supplied two years earlier	2,150,000
Net discounted cost, river supply	$35,944,000
Corresponding cost of gravity supply, as computed by a majority of your commission	$35,861,000

He computes the cost of operation at $18.21 per million gallons and computes a reduction in discounted cost of the river plan of $2,330,000 if this estimate can be realized.

Regarding the gravity supply the majority report goes into a detailed description of the water sheds of Water Fork, Dry Fork and Courtois, from which, with springs probably drawing from other water sheds, the supply will be gathered, showing the excellent quality of the water and its probable continuance in good condition. The dams, conduits, reservoirs, etc., are also described in general terms. The estimate details cost of land, dams and appurtenances, amounting to $4,538,000; conduits, $14,901,900; covered reservoirs, $1,994,000; pipe line to connect with distribution system, $3,586,520; making a total of $25,020,420, increased, with engineering, interest during construction and financiering added, $7,058,280. When credits are made for old materials and land to be sold the total estimated cost is $31,000,000. If the cost of operation is capitalized it adds $4,861,000, making the total $35,861,000. In the same way the capitalization on the basis used in the majority report of the purification system is $39,736,000. Mr. Hazen's criticism of these figures is given above. He also thinks that while the majority report overestimates the cost of the filtration plan it underestimates the cost of the gravity plan.

Contest of Water Companies at Utica, N. Y., Decided.

A decision has been handed down by the appellate court at Rochester, N. Y., in the case of Charles Coolman vs. the Whitestown Water Works Company. The common council of Utica, N. Y., granted a water franchise to the Whitestown Water Works Company. Mayor Sherman vetoed the resolution granting the franchise. Charles Coolman, as plaintiff, although the Consolidated Water Company was the real plaintiff, obtained an injunction restraining the common council from overriding the veto. Before the time during which the veto might, under the charter, be overridden had expired the Whitestown company obtained an order modifying the injunction so that the aldermen might vote on the mayor's veto. The aldermen then overruled the mayor's veto. Coolman made a motion to have the order modifying the injunction vacated, but the motion was denied. An appeal was taken from their ruling, but the appellate court affirmed the order of the lower court with $10 and costs and disbursements.

Existing Franchise No Bar to Public Water Plant in New York Cities.

The United States supreme court rendered a decision March 4 in the case of the Skaneateles Water Works Company vs. the village of Skaneateles, N. Y. The litigation began in October, 1896, and involved the right of a municipality to reestablish a water system of its own after having granted a franchise to an independent company which had subsequently put in a water works plant.

The decision affirms with costs the judgment of the court of appeals of New York state in favor of the village, and firmly establishes the principle that the granting of such a franchise does not estop the municipality from constructing and operating its own plant.

Right to Use Water from Niagara River Is Taxable.

The appellate division of the supreme court at Rochester, N. Y., has decided that the right to take water from the Niagara river is taxable, and upholds the assessors of the city of Niagara Falls. When the assessment was first protested against, a review of the assessment was asked for by the Hydraulic Power and Mfg. Company, which objected to an assessment on this matter. Justice Childs upheld the assessors and the appellate division affirms his decision. The Hydraulic Power and Mfg. Company and the city agreed some time ago that the company would pay the taxes thus assessed under protest. About $9,000 a year was involved.

Damage by Electrolysis.

From the annual report of the department of public works, Rochester, N. Y., we have taken two illustrations of damages to service pipes by electrolysis and the following statements of the results of the investigation and description of the various examples shown.

The damage done to the water pipe system by electrolysis, so far as known, has been confined to the services, and almost entirely to the lead and composition service. These damaged services have generally been discovered upon opening the trenches where a new pavement in the street has been under construction. In some cases, however, the damaged services were made evident by leaks. In 1894, 3 of these leaky services

were found; in 1895, 8; in 1896, 8; in 1897, 6, and in 1898, 2, all bearing unmistakable evidence of being damaged by electrolysis. Many other services that were replaced were slightly damaged, but the evidence of electrolytic corrosion was not so definite. It is impossible to tell when this damage was done and it is not known to what extent the services are injured in other streets where they have not been examined. Several cases of serious damage to the lead-covered cables in the ducts of the Rochester Gas and Electric Company have been discovered; one on South-ave., near Court-st., two on State-st., near Allen-st., and one on Mill-st., at Central-ave. It is reported that cables have been found affected in other streets, but no data on the subject are available.

The photographs of services found damaged by electrolysis are described as follows:

1. South-ave. (power cable).
2. Mill-st. (telephone cable).
3. State-st. (power cable).
4. No. 171 Clinton-ave., under rail, west side.
5. No. 25 Clinton-ave., north, under old water main. Found leaking when uncovered.
6. No. 171 Clinton-ave., north, under track.
7. Clinton-ave., at railroad.
8. No. 187 Clinton-ave., north, under east track.
9. No. 213 Clinton-ave., north, under rail, west side.
10. No. 67 Clinton-ave., north, under west rail. Found leaking.
11. No. 39 Elm-st., under east track.
12. No. 41 Elm-st., under east track.
13. No. 179 Central-ave., under south rail near gas main.
14. No. 179 Central-ave., under south rail near gas main.
15. No. 191 Central-ave., under south rail near gas main.
16. No. 159 Central-ave., under gas main south side.
17. No. 167 Central-ave., under south rail near gas main.
18. No. 466 North-ave., under east rail near water main.
19. No. 437 North-st., under rail.
20. No. 174 Monroe-ave.
21. No. 56 Monroe-ave.
22. No. 256 Monroe-ave.
23. No. 244 Monroe-ave.
24. No. 96 Monroe-ave.
25. No. 20 Monroe-ave.

Location of Gas Mains in Traverse City Must Be Approved by Council.

The case of the Traverse City Gas company against the Mayor and Common Council of Traverse City, Mich., which was decided by Judge Mayne and reported on page 344 of Municipal Engineering for November, 1901, was carried to the Supreme Court of the state and has just been passed upon, the decision having been filed March 18. The principal point in the case is regarding the right of the city to regulate the location of gas mains in its streets, and the decision of the court in favor of that right is stated in terms very similar to those used by Judge Mayne. The court says in part:

In the brief, counsel for relators say, "When the city granted the franchise to relator by section 1, it invested the relator with the absolute right to lay its pipes in any of the streets, alleys or public places in said city, whenever the relator might deem it expedient so to do." Kalamazoo vs. Kalamazoo Heat, Light and Power company, 82 N. W. R. 311.

We think counsel states the rule wrongly. A reference to the case will show that in the franchise there granted the city failed to reserve the right to say where the pipes should be laid, and it was said in view of that situation. ... is doubtless true the ordinance was not a wise one to make, but it was within the power of the council to make it and the city was bound by its terms. It is not probable had the city reserved the right to have the pipes laid in the alleys the reservation would not have been upheld."

In this case the council, unlike the council in Kalamazoo, reserved to itself the right to say "That said main pipes shall be laid in alleys whenever practicable and when so ordered by the council," and required the corporation before laying pipes to obtain the permission of the council. The first time permission was granted to lay any pipe the same committee which reported in favor of granting that permission reported out the present plan, which was adopted at the same time the permission was given. Before a foot of pipe was laid by the corporation it knew what interpretation the council put upon the provisions of sec. 7. The provisions of this section are as much a part of the agreement the relator has with the city as any part of it. If the contention of the relator is to prevail, the attempts of a common council when granting like franchises to safeguard the interests of the city or village for which it is acting, will prove abortive, and when the franchise is once granted the control of the city or village over the streets is lost.

It has not been made to appear that the laying of the pipes in the alleys as required by the council is not practicable. The order of the circuit court is affirmed.

Claims for Double Lighting Service in Denver Passed Upon by Court.

The temporary injunction issued last December by Judge Mullins restraining the city of Denver, Col., from paying the Lacombe Electric Company $55,920 for lighting the city for the last nine months of 1901, was dissolved by Judge Johnson March 10.

The injunction was asked for by the Denver Gas and Electric Company. Judge Johnson held that the Denver Gas and Electric Company had no claim on the city for furnishing light during the same

period, when it furnished lights in direct disregard of an ordinance passed by the city council in December, 1900, and in an amended form in January, letting the lighting contract to the Lacombe Company. The plaintiff company claimed that the fact that it had supplied the city with lights for several years and that the city had accepted and paid for lights for the first three months of 1901 was prima facie evidence o. implied contract for 1901. The court held that there was no evidence of a contract implied or otherwise. Judge Johnson says:

The plaintiff company sues out a bill in equity to recover an alleged unpaid cash balance due from the defendant, the city of Denver, upon an implied contract for furnishing lights to the city for the months of April to December, inclusive, in the year 1901. Subsequent to the year 1895, and up to 1901, the plaintiff company furnished lights to the city and was paid for the use of same without any written contract or direct order from the city as per requirement of the city charter. In the year 1900 the city of Denver, through its legislative body, passed an ordinance which, in substance, informed the plaintiff that it would not enter into a contract for furnishing lights for the year 1901 with plaintiff, but that the defendant, the Lacombe Electric Company, should have the contract as soon as its plant was built and ready for use.

The plaintiff, however, disregarded this arrangement on the part of the city and refused to discontinue its light service.

The Lacombe company, not having finished its plant until about April 1, 1901, the city continued to patronize the plaintiff company, and without objection used its lights for the months of January, February and March, 1901; that it paid plaintiff for use of same and notified it, through the mayor, that its light service was no longer required and would not be accepted. However, plaindiff continued to furnish said lights, along with the Lacombe company, so that the city was favored with double light service for the balance of the year.

Under these facts I do not believe the city of Denver is liable to the plaintiff company upon an implied contract of one year, or for services rendered which have not been paid for. To force a contract of this nature upon the city, under such circumstances, would be most inequitable, as I view it. If the mere fact that because the city had the use of plaintiff's lights, furnished under protest, makes it liable, much more reasonable would it be that the Lacombe people receive pay for use of its lights. I think the Lacombe Electric company has the better right to the fund in controversy. For these reasons the injunction writ heretofore issued will be dissolved, the plaintiff's bill dismissed and judgment entered in favor of defendants.

Special Assessments for Street Lighting Proposed in Chicago.

A proposition has been made by City Electrician Ellicott of Chicago to keep the city lighting system up to the standard. Owing to his budget being reduced by the city council he intends to shut off 100 arc lamps and 1,500 gasoline lamps. He says that the lighting system will never be properly handled until the cost of lighting is met by special assessments instead of by taxation. This would mean that property-owners in a block could have all the light they desired if they paid for it.

Largest Electric Transmission Line in the World.

The Missouri Power Company of Helena, Mont., has recently completed the largest and longest transmission line of electric power in the world. The line extends from the company's dam and plant at the Missouri river to Butler, Mont., is sixty-five miles long and crosses the main range of the Rocky mountains at an altitude of 7,.00 feet, and a spur of the main range at an almost equal hight. The power line conveys 12,000 horse-power now, although the installation of the transmission plant is intended to convey double that quantity when the additional dam which the company contemplates is completed. A site for the dam has been selected.

The transmission line consists of two complete lines on parallel poles of three large cables each. The double line covering sixty-five miles, required over 7,000 poles, varying in hight from 35 to nearly 80 feet. Copper wire cables are employed, carried on heavy glass insulators nine inches in diameter and of a special design devised by the chief engineer of the Missouri River Power Company, M. L. Gerry, Jr.

Council Cannot Alienate Control of Streets by Ordinance or Franchise.

A decision has been handed down by Judge John H. Baker of the United States circuit court in the case of the Logansport Railway company against the city of Logansport, Ind., and others.

The city of Logansport granted a franchise in 1882 to the Logansport Railway company covering all streets in perpetuity, the company to use such streets as it saw fit. In October, 1901, the city council passed an ordinance repealing the original franchise ordinance except as to streets in which the company had already laid tracks and was operating cars. The street railway company then brought action in the federal court to enjoin the city and officers from enforcing the repealing ordinance. Judge Baker sustained the demurrer to the complaint, holding that the latter ordinance was valid and the city had the right to repeal the fran-

chise on streets where lines were not already constructed.

Among the important sentences of the decision are the following:

The fee of the streets in cities in this state resides in the abutting lot owners, and the city possesses only an easement of way in the streets. It does not hold title to the easement as a private property right which it may alienate at pleasure as it might alienate property belonging to the city by a title unimpressed with a trust.

The act of 1861 simply provides that the street railway company shall first obtain the consent of such common council to the location, survey and construction of its railroad before the construction of the same shall be commenced. No words of perpetuity are expressly employed. The same is true of the act of 1891.

It must be held here that similar and no broader language employed in the acts of 1861 and 1891 above mentioned does not explicity and directly confer the power on the common council of the city of Logansport to grant either an exclusive or a perpetual privilege to occupy its streets for railway purposes.

That such powers must be given in language explicit and express or necessarily to be implied from other powers is now firmly established. * * *

But there are other reasons why the bill cannot be maintained. The ordinances of 1882 and 1891 grant the exclusive right to use in perpetuity certain streets designated by name, and also the right to use and occupy such other streets and bridges in the city as the street railway company may from to time elect to use and occupy. The repealing ordinance expressly excepts from its operation all the streets and parts of streets occupied and in use by the complainant at the time of its adoption. Its effect is simply to repeal so much of the ordinance of 1882 as purported to grant to the complainant the right to use and occupy such other streets of the city as it might from time to time elect to use and occupy, and also to repeal so much of the ordinance of 1891 as purported to grant to the complainant the right to use and occupy at its election all the streets of the city then existing or thereafter to be established, in perpetuity. The right granted, except as to the designated streets, was a mere offer, which could only become a contractual obligation by the election of the complainant to use and occupy the streets for railway purposes. Such election must be made in good faith and evidenced by some open and notorious act brought to the notice of the common council. Until the offer was accepted by such an election it could be withdrawn.

But the grant is open to a more serious objection. It was ultra vires of the common council to surrender its control of the streets of the city in perpetuity to the complainant. The municipal authorities had no power to grant forever to the complainant the right to its own uncontrolled election to use and occupy such or all of the streets of the city as it might from time to time elect. The right to determine of itself from time to time what streets could be used and occupied for street railway purposes consistently with the public safety and welfare is a power incapable of absolute alienation by the common council. By these ordinances the common council has undertaken to surrender this power and to remit it to the uncontrolled election of the complainant.

The only power reserved is the power, if the common council wishes the railways to be extended along a particular street, to notify the complaint of such desire, and if it fails within one year to construct and operate its road on such street then the use of such street may be granted to another railway company. But no right or power is reserved to prevent the railway company, at its election, from using, with a double or single track, any and all the streets of the city, however injurious it may be to the public convenience, safety or welfare. The public convenience, safety and welfare in this regard are surrendered to the complainant. Such a surrender of corporate power in perpetuity to a street railway company cannot and ought not to be upheld. The bill cannot be maintained for another reason. The general consent conferred by the original ordinances to occupy and use all of the streets of the city for railway purposes did not satisfy the statute, nor take away from the common council the right, before the railway company should construct a street railway upon an unoccupied street, to require it to obtain the consent of the common council to its location, survey or construction.

Detroit's Three-Cent-Fare Ordinance Declared Irregular.

The United States supreme court rendered a decision March 3, holding that the ordinance enacted by the city government at Detroit, Mich., arbitrarily reducing street car fares to 3 cents was irregular and not binding. The court's decision was based upon the fact that previous ordinances had been passed fixing the street car fares at 5 cents, and these original ordinances were construed by the court to be in the nature of contracts.

A Clinton, Ill., Paving Assessment Declared Invalid.

The Illinois supreme court has rendered a decision in the paving assessment case brought by the city of Clinton, Ill., against the county of DeWitt. The city brought suit to compel the county to pay $3,000 as its part of the special assessment for paving the square around the court house. Judgment was given in the county court and the case was taken up by the county on a writ of error and the decision was reversed.

The court held that the ordinance is invalid in that it does not establish a grade

according to law, and confers power on the city engineer to establish the grades, which conferring power is illegal. It is held that the provision for "raised crossing is illegal and of no force, as it states that raised crossings should be placed in such places as the board of local improvements shall deem necessary." The ordinance should state where the raised crossings were to be placed, and their failure to do so specifically invalidates this provision. The term "approaches to the square" and the term "pubilc square" are declared to be not sufficient description.

The entire ordinance is declared illegal and of no force, and the decision of Judge Staley of the lower court is reversed without remanding.

Comparison of Macadam Materials and Binders.

A report was made March 8, by J. Vinton Dart, assistant engineer in charge of highways at Providence, R. I., of the cost and comparative merits of the various kinds of macadam pavement laid in Broad-st., between W. Friendship and Moore-sts., last summer. The results show that the experiments brought out considerable new information, and that the city can have more durable and satisfactory pavements of broken stone than were laid before it was decided to test different combinations of stone. The stone tested was from Cumberland Hill, Diamond Hill, Neutaconkanut Hill, and the boulders found in the fields in or near Providence. The report says: "Broad-st. is from 66 to 80 feet wide, but the westerly side, between the car track and cobble gutter is only 10 feet wide, and was selected in order to give the experimental paving the severest test as to binding qualities, the strip being so narrow that the horses follow each other nearly in track. The binders used were, (1) ironstone (peridotite about 40 per cent. iron) and limestone passed through a quarter-inch screen, the proportions being nine-tenths iron and one-tenth lime; (2) bituminous macadam, or tar binder; (3) Diamond Hill quartz crushed to half-inch size, and dust; (4) field stone crushed to half-inch size, and dust. The street was excavated to a depth of about five inches, and the material removed was used on the highways having less traffic. After this excavation a layer over five inches thick remained as a foundation for the new work. This section was made parallel with the finished surface and four inches below. Then the broken trap was put on in two layers. The first was three inches in depth and the size was 2½ inches to 1½ inches. The second was about two inches, or enough to finish the work to section, and the size was 1½ inches to ½ inch. In the treatment of the ironstone the binder was laid on the loose stone dry after the roller had passed over it a few times to shape the section; then it was brushed into the interstices used only when finishing the rolling."

The samples of macadam were inspected frequently during the season by Engineer Dart, who is convinced that the iron and limestone binder stands first in merit when compared with the trap work, the field stone and the Diamond Hill quartz. The general appearance of the tar macadam is better, however, than any of the others named, and this piece of paving is preferred for smoothness and hardness. He says:

The combination of iron and limestone did not give all the cementing value that was expected from oxidizing or rusting, the Cumberland Hill rock having little tendency to rust when exposed to the weather. Notwithstanding this it stands easily at the head of all the binders used here, excepting the tar, and the great advantage of the iron stone is that when finely ground it does not blow away in the form of dust, which cannot be said of the top dressing made of trap rock and field stone. Its weight keeps it where laid, and under the wear of wheels is not affected by the wind.

A roadway with iron rock binder is not unlike a trap rock street properly sprinkled twenty-four hours a day, and offers the inducement of relief from the dust nuisance, which is very troublesome and detrimental to the health at least six months of the year.

Philadelphia's New Pavements.

In his annual report submitted March 5 Chief Brooks of the bureau of highways, Philadelphia, states that the old cobble and rubble pavements of that city are fast being replaced with new and improved pavements. During the last three years $3,350,000 has been expended in repaving with improved avements under a maintenance guarantee of ten years. During 1901 17.88 miles of new streets, covering 275,666 square yards, were paved with asphalt, granite blocks and vitrified brick on cement concrete foundations. The approximate value of the work is $760,000, of which sum $161,512.24 was paid by the city for paving intersections. There was also constructed during the year 18.19 miles of new macadamizing, 22.40 miles of repaving with new pavements, paid for by the city, and one mile paid for by passenger railway companies, and 1,029,731 cubic yards of street grading, roads and sidewalks.

Guarantee Clause Makes Pennsylvania Street Assessments Invalid.

A decision was rendered by Judge Walling, March 4, in the suit brought by the city of Erie, Pa., to compel East Third-st. property-owners to pay for a pavement constructed in 1901. Judge Walling held that the clause requiring the contractor to give a guarantee that the pavement will last at least ten years and that he will keep it in repair for that length of time, is illegal because it imposed a double cost on the property-owner. He must pay enough for the pavement so that the contractor can keep it in repair for that length of time, thereby being required to pay for the pavement and its maintainance for ten years.

In granting the motion for a non-suit, he says:

The city, under certain conditions, has the right to pave a street, which has never been paved, and assess the cost of such pavement against the abutting property. But when a street has once been paved the property cannot be assessed or made liable for a repavement, nor for keeping such pavement in repair. When a street has once been paved the liability of the property-owner ceases. Here we have not only a street paved but a street kept in repair for ten years, at the expense of the property-owner. Now while the original pavement might have been constructed at the expense of the property-owner the property-owner cannot be made liable for the repairs which may become necessary on that street for ten years.

The city has a right to make a contract to pave a street and require in the contract that the contractor shall keep it in repair for ten years. But when it comes to charging a property-owner with the cost of the pavement, that may be done, but not with the additional cost of the making of the repairs.

Here they are blended, and it is impossible for the jury, or for the court, to say what part of this original cost was for the pavement and what part of the cost was for guaranteeing to keep it in repair for the ten years.

Every bid submitted was made not only on the basis of building a pavement, but of keeping it in repair for ten years. That being so the cost of the ten years' repairs entered into the bid for the improvement.

In my opinion, so far as assessing the cost on the property-owner is concerned it rendered the whole assessment null and void.

By the ordinance the city engineer and the mayor are made the agents of the city, and they have drawn and executed this contract, and in my opinion the city is bound by it, and cannot repudiate any part of it. And what the city could not accomplish by an ordinance it cannot accomplish by a contract; it cannot compel a property-owner to pay for the expense of a pavement and also for the expense of keeping it in repair ten years, neither can it do so by a contract made by its agents.

If this assessment can be enforced as it stands, blending the cost of the original pavement and the cost of the keeping in repair, for ten years, then the city might make a contract which would compel the property-owner to keep a pavement in repair for twenty years, or for fifty years.

It is not a question of the guaranty of good workmanship or of good material, but of keeping a pavement in repair for ten years, which entered into the cost of this improvement, and which renders it invalid, so far as making an assessment therefor against the property-owners, in my opinion.

Statisitics of Paving in Iowa Cities.

The board of public works of Des Moines, Ia., recently collected data and prepared a table showing the amount of paving in Iowa cities. The table is as follows:

	Miles.	Population.
Des Moines	56.	62,139
Dubuque	4.75	36,254
Davenport	23.	35,254
Sioux City	4.40	33 111
Council Bluffs	11.	25,802
Cedar Rapids	13.5	25,656
Burlington	11.93	23,201
Clinton	13.	22,689
Ottumwa	6.5	18,197
Keokuk	1.6	14,641
Muscatine	No report	14,073
Waterloo	5.	12,162
Fort Dodge	1.20	12,107
Marshalltown	6.69	11 544
Fort Madison	No report	9,278
Oskaloosa	9.	9,212
Boone	1.76	8,880
Iowa City	1.82	7,987
Mason City	.91	6,746
Charles City	.21	4,227
Newton	.75	3,682
Albia	1.	3,147

The greater portion of this paving is brick. Asphalt is found in Des Moines, where there are 29,238 square yards; Sioux City, 144,794 square yards; Ottumwa, ¾ of a mile and Cedar Rapids 2½ miles. Dubuque has 88 miles of macadam, leading all cities of the state, and while it has a small amount of brick paving, there are no end of good roads leading to the city and through all the principal sections. Sioux City has 8,125 square yards of macadam; Cedar Rapids, 22,500 square yards, and Burlington, 7,591 square yards, while Clinton has 7.37 miles, Ottumwa one-half a mile and Keokuk 2.35 miles. Sioux City has 212,437 square yards of block paving, and 48,949 of block stone for the business district. Council Bluffs has 152,500 square yards of block (wooden), and 73,200 yards of granite blocks.

Burlington has 1.49 miles of stone block paving.

In Des Moines brick paving cost on an average during the past season, according to figures taken from the contracts, which the board has let, $1.65. In Davenport brick paving cost $1.30, but it is claimed that the specifications are not so rigid as those required by the Des Moines board. For two course brick Sioux City paid $1.71 to $1.83, while Council Bluffs and Cedar Rapids had some work done as low as $1.25, and from that to $1.80. Other cities have forwarded figures as follows: Burlington, $1.34 to $1.84; Clinton, $1.20 to $1.36; Ottumwa, $1.40; Keokuk, $1.35 to $1.68; Waterloo, $1.20 to $2.10; Marshalltown, $1.15 to $1.80; Ottumwa, $1.39 to $1.60; Boone, $1.14 to $1.69; Mason City, $1.65 to $1.96; Charles City, $1.26; Newton, $1.43 to $1.53.

For asphalt paving Des Moines paid an average of $1.98. Sioux City paid $2.56 and Ottumwa (native asphalt), $1.58. For macadam Dubuque pays an average of 55c per square yard; Council Bluffs, 49.33c; Burlington, 72c, and Keokuk, 43c to 68c. The last wooden block laid in Sioux City cost $1.33 per square yard and the last at Council Bluffs cost $1.40. Burlington has paid for limestone blocks $1.25 and for granite blocks $2.75. Council Bluffs pays for the best granite blocks $3.48.

N. B. M. A. Meeting Recommends Method of Laying Brick Streets.

The sixteenth annual convention of the National Brick Manufacturers' Association was held in Cleveland O., Feb. 10 to 15. Among the papers submitted were the following: "Modern Brick Plant Prospecting and Construction," Frank W. Butterworth, Danville, Ill.; "Economy in Building and Repairing Permanent Kilns," C. B. Stowe, Cleveland, O.; "Burning Brick With Oil," George H. Drew, Blue Island, Ill.; "The Permanent Improvement of Public Highways," William H. Evers, C, E., Cleveland, O.; "Drying Brick With Waste Heat from Cooling Kilns," J. W. Sibley, Birmingham, Ala.; "Drying Brick with Waste Heat from Cooling Kilns," Robert Twelks, Elyria, O.

The committee on specifications for the construction of brick pavements, consisting of D. V. Purington, T. B. Townsend and Will P. Blair, reported that the members had held several meetings during the year and had used their best efforts to secure the co-operation of the American Society of Municipal Improvements, but with limited success. They believe that the best direction for building the highest and best grade of brick streets is included in the following:

Substructure or Grading—Earth in excavation to be removed with plow and scraper, or other device, to within two (2) inches of subgrade, then brought to true grade with the roller, the weight of which should not be less than five (5) nor more than eight (8) tons. If the earth is too hard to receive compression through the weight of the roller, then loosen the remaining two (2) inches with a pick and cart away.

Earth in embankment must be applied in layers of eight (8) inches in thickness and each layer thoroughly rolled, and in both excavation and embankment the subgrade must have a uniform destiny.

If the ground is a spouty clay, tile drainage should be provided to carry off this accumulation of wet.

Curbing—If cement is used it should be completed; if stone, all should be hauled and distributed and set before the grading is finished, and then may be used as a guide to finish the subgrade.

It should range in thickness from four (4) to six (6) inches, twenty (20) to twenty-four (24) inches wide, the business and street traffic governing the same, and lengths not shorter than five (5) feet, except at closures, neatly dressed on top with a square or rounded outer edge and four (4) inches down on the inside. The outer surface to be tool dressed to the depth of the face exposed and to the depth of the thickness of the brick and sand cushion. The intersection at street corners and alleys should be circular, with radius of four (4) and three (3) feet respectively.

Marginal Curbs—Should always be of a hard and durable character of stone and from fourteen (14)to eighteen (18) inches deep, dressed on top and five (5) inches down on the face next to the brick.

Set to accurately fit the curvature of the cross-section of the street, on six (6) inches of concrete and backed up with the same within six (6) inches of the top.

Concrete Foundation: Crushed Stone—Should be of approved quality of hard rock, with no fragment larger than will pass through a two (2) inch ring and none smaller than will pass through a one (1) inch ring in their longest dimensions, free from all refuse and foreign matter.

Sand—Must be clean, sharp and dry and thoroughly mixed in its dry state until the whole mass shows an even shade, with an approved brand of either hydraulic or Portland cement. If of hydraulic, the proportion of mixture should be one part of cement and two parts of sand; if of Portland cement, one part of cement and three parts of sand.

To the above mixture should be added sufficient clean water to mix to a plastic mass, fluid enough to rapidly subside when attempting to heap to a cone shape. To this mixture add four (4) and five (5) parts, respectively, of damp, crushed stone or clean screened gravel, and turn the whole mass over not less than three (3) times, or until every fragment is thoroughly coated with the cement mixture. For the reception of this mixture the grade

should be set off in five (5) foot squares, with a stake at each corner. Tops of each should be at the surface of concrete, which must be tamped until free mortar appears at the surface. Occasional sprinkling in extreme hot, dry weather is beneficial. After thirty-six hours the cushion sand may be spread.

Sand Cushion—Sand should be clean and free from foreign or loamy matter. It need not necessarily be sharp. It should be two (2) inches thick before the compression of the brick by rolling. The sand should be spread, by the aid of a template, the whole or one-half the width of the street, made to conform with the true curvature of the street cross-section.

Brick—The brick should all be hauled and neatly piled inside of the curb line before the grading is finished, or, if allowed by the engineer, delivered on the street in wagons and carried from the pile or wagon on pallets or with clamps, and not wheeled with barrows. They should be first-class and thoroughly vitrified, showing at least one fairly straight face, with rounded edges, with no greater radius than 3-16 of an inch. They should not be less than 2½x4x8, or more than 3¼x4x9 inches, free from cracks, with but slight lamination and at least one edge with but slight kiln marks allowed.

Such brick or blocks shall be submitted to a test of one hour in the National Brick Manufacturers' Association standard rattler, and under the conditions prescribed by that association, and if the loss by abrasion during such test exceeds 20 per cent. of the original weight of the brick tested, then such brick or blocks shall be rejected.

Brick Laying—Brick should be laid perpendicular to the curb. Broken brick or block can only be used to break joints in starting courses or in making closures. The brick shall be laid on edge, close together, in straight lines across the roadway between gutters. Gutters shall be constructed as directed by the engineer. After the brick are laid they shall be thoroughly inspected, and all warped, spalled and soft brick removed and replaced by more perfect ones, and those found with the bad face up should be turned down.

Tamping and Rolling—After the inspection is thus completed the edge of the pavement shall be tamped to grade next to the curb, to the width of six (6) or eight (8) inches out from the curb, with a hand tamper. The entire pavement shall then be rolled with a five (5) ton steam roller until all brick are thoroughly bedded and the whole surface assumes a practical plane.

Expansion Cushion—An expansion cushion must be provided for, one inch thickness next to the curb, filled 2-3 its depth with pitch, the top 1-3 being filled with sand, and a like cushion, at right angles with the street at intervals of fifty feet.

The Filler—The filler shall be composed of one part each of clean, sharp sand and Portland cement. The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cement, shall be placed in the box and mixed dry, until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

From the time the water is applied until the last drop is removed and floated into the joints of the brick pavement, the same must be kept in constant motion.

The mixture shall be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be 3½ to 4 feet long, 27 to 30 inches wide and 14 inches deep, resting on legs of different lengths, so that the mixture will readily float to the lower corner of the box, which should be from 8 to 10 inches above the pavement.

This mixture, from the moment it touches the brick, shall be thoroughly swept into all the joints. Two such boxes shall be provided in case the street is twenty feet or less in width; exceeding twenty feet in width, three boxes should be used.

The work of filling should be thus carried forward in line until an advance of from fifteen to twenty yards has been made, when the same force and appliances shall be turned back and cover the same space again in like manner, except that the mixture for the second coating may be slightly thicker than the first.

To avoid a possibility of any great thickening at any point, there should be a man with a large sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers. This should be done in the application of each course here specified.

After the joints are thus filled flush with the top of the bricks and sufficient time for evaporation has taken place, so that the coating of sand will not absorb any of the mixture, one-half inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

The grouting thus finished must remain absolutely free from disturbance or traffic of any kind for a period of ten days.

Officers for the ensuing year were elected as follows: President, George M. Fiske of Boston; first vice-president, Clifford Chase of Milwaukee, Wis.; second vice-president, H. C. Bradley of Cleveland; third vice-president, John C. Miller of Washington, D. C.; secretary, T. A. Randall of Indianapolis; treasurer, John W. Sibley of Birmingham, Ala.

Denver Garbage Ordinance Legal.

Judge Carpenter of the district court, Denver, Col., decided, March 17, that the city garbage ordinance was valid and the letting of the garbage contract regular. The injunction asked for by Alonzo S. Bosserman and R. F. Cushing to restrain the authorities from preventing

the plaintiffs from hauling garbage was denied. Bosserman and Cushing alleged that the contract given to the Worthingtons for hauling garbage was the result of a conspiracy between the mayor and health commissioner, and averred that no one else had a chance to bid; that they owned a hog ranch near the city in which they had invested $3,500 and that unless they were permitted to haul garbage from the city their business would be ruined. They also asserted that the Worthingtons were members of the Hog Growers' union, and that a conspiracy existed to drive them out of the business.

Board Controlling Fire Department Cannot Be Appointed by Governor in Indiana.

The Indiana supreme court holds that the act passed by the legislature, at its last session, authorizing the governor to appoint a board of safety for Ft. Wayne, having control of that city's fire and police departments, is unconstitutional. The provisions for control of the fire department make the act invalid, but they are so involved with the police provisions that the latter cannot be separated, and the whole act fails.

The members of the board of safety appointed by the governor had tendered their bond for approval, but the comptroller of Ft. Wayne refused to approve them. An action for mandamus to compel him to do so was brought. The circuit court refused to issue the writ. The case was appealed with the result that the supreme court affirmed the decision of the lower court.

New Orleans Sewer Company.

Nearly ten years ago the city of New Orleans granted a franchise to the New Orleans Sewer Company to construct and operate a sewer system. A part of the system was constructed about 1895, but the terms of the franchise have never been entirely fulfilled. When the city undertook the task of furnishing adequate water supply and sewerage for the city and the water and sewer board was established, the sewer company practically abandoned its work. The new plans for sewers are designed to use nearly all of the sewer company's lines. The company first asked $400,000 for its property and rights, later reduced the claim to $350,000 and again to a final offer to sell for $295,000. The water and sewer board sent a communication to the city council proposing to accept this last offer. It has various estimates of the value of the property, ranging from $170,000 to $229,000 and considers that the difference between the actual value of the property and the claim of $295,000 by the company is well spent in obviating the delay which would be necessary to declare the sewer company's franchise forfeited and to secure a court decision fixing the amount to be paid. This difference is apparently the amount which the sewer company sets as the value of the franchise rights which have been destroyed by the assumption by the city of the construction of the sewerage and drainage system. On the other hand, it is claimed that the company has no franchise rights, since it has never completely fulfilled the provisions of the ordinance granting the franchise.

A council committee has recently been considering the matter, and after hearing considerable evidence, has made a report to the council approving the recommendation of the water and sewer board.

Technical Meetings.

The annual convention of the American Society of Civil Engineers will be held in Washington, D. C., May 20. C. W. Hunt, Secy., 220 W. Fifty-seventh-st., New York City.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Boston, Mass., May 27. F. R. Hutton, secy., W. Thirty-first-st., New York City.

The March meeting of the New England Water Works Association was held at Young's hotel, Boston, Mass., March 12. H. W. Clark, chemist of the Massachusetts board of health, was to have submitted a paper on "Investigations in Regard to Coloring Matter in Water and Methods of Renewal," but was unable to be present. President Merrill called upon Desmond Fitzgerald, M. Am. Soc. C. E., to speak informally on this subject. Mr. Fitzgerald gave a brief outline of the work that has been done in connection with the removal of color from Boston's water, and called attention to the fact that with New England's surface waters the color is almost always due to organic matter of a peaty nature, and that by draining the swamps upon a watershed a considerable percentage of the color of its water can be removed and another large percentage of color may be gotten rid of chemist and biologist at the New Orleans by storage and bleaching. R. S. Weston, experimental filtration plant, called attention to some of the work on the Mississippi and other very turbid waters, and said that some highly colored tributary streams seem to lose nearly all their color after confluence with the sediment-bearing Mississippi. A paper was presented by Caleb Mills Saville, M. Am. Soc. C. E., on "The Forbes Hill Reservoir and

Standpipe of the Metropolitan Water Works."

The annual meeting of the Boston Society of Civil Engineers was held March 19.

The annual meeting of the Iowa Electrical association will be held in Cedar Rapids, Ia., April 9 and 10.

The annual meeting of the League of Wisconsin Municipalities will be held at Grand Rapids, Wis., June 5 and 6.

Mayor Welch of Alexandria, La., has issued a call for a meeting of the mayors and boards of aldermen of the different towns of Louisiana to meet in Alexandria some time during April. The object of the meeting is for the passage of resolutions to be presented to the incoming legislature upon such matters as may be of help to the various municipalities of the state.

The convention of the Northwestern Brick Manufacturers' association was held at Princeton, Minn., March 4.

The next meeting of the American Society of Municipal Improvements will be held at Rochester, N. Y., Oct. 7-9, 1902.

New Publications.

Roberts's Car Measure. A short and easy method for computing contents of cars where cubic yards are required. 63 small pages, $5. E. K. Roberts, Detroit, Mich.

This is a set of tables giving the area of cars of different lengths and width in the form of a coefficient by which to multiply the depth of material in the car in inches to obtain the contents in cubic yards.

Report of the Sub-Committee on Uniformity in Analysis of Materials for the Portland Cement Industry. Reprinted from the Journal of the Society of Chemical Industry, Jan. 15, 1902.

Mr. Clifford Richardson of the New York Testing Laboratory, Long Island City, N. Y., was the chairman of this committee and copies of the report can doubtless be obtained from him by those who are interested. It is an inquiry into the methods used by analysts of cement and cement materials and a recommendation of a standard process, and should be of great value to all cement chemists and analysts.

Earth Roads. By Maurice O. Eldridge, Assistant Director, Public Road Inquiries, U. S. Department of Agriculture. Washington, D. C.

The efforts of the road inquiries office to supply the assistance needed by those engaged in improving country roads cover all the branches of the subject. There was some complaint a year or so ago that earth as a road material had been neglected by the department and Prof. Baker, in particular, has made so strong a plea in its behalf that it has had the effect of diminishing the value of his discussion by giving the impression of excessive partisanship. This pamphlet considers the practical location of earth roads and the effect of grades; the absolute necessity of perfect drainage, both slope and sub-surface, including materials of which drains and culverts should be made, and the value of the roller, and gives valuable hints on cross-section, width, elevation, rolling, treatment of clay and sand roads, as well as upon repairs, showing the necessity of prompt repair, the value of wide tires and the use of road machines.

If the suggestions of the pamphlet are followed, an education in the value of good roads will result, w...ch will lead to better construction, though some may consider such a treatment of the subject as delaying the cause of good roads.

The Theory and Practice of Modern Framed Structures, Designed for the Use of Schools and for Engineers in Professional Practice. By J. B. Johnson, C. E.; C. W. Bryan, C. E., and F. E. Turneaure, C. E., 527 pp., cloth; $10. John Wiley & Sons, New York.

The first edition of this book appeared in 1893, and it immediately took a high place in the literature on the subject, the ability of the authors of the various chapters and of the editor making it authoritative. Prof. Johnson acted as editor and was the author of the chapters upon the principles and history of the truss, methods of analysis, beams, continuous girders, columns, combined stresses, suspension bridges, deflections, redundant members, the Howe truss, trestles, elevated roads, standpipes and tanks. Prof. Turneaure is responsible for the chapters upon the theory of equilibrium, methods of analysis of roof-trusses, bridge trusses with uniform and with concentrated loads, lateral trusses, swing bridges, cantilevers and arches. Mr. Bryan writes from the standpoint of the practical constructor with full theoretical knowledge the chapters on styles and conditions of structures, design of individual members and details, of plate girders and roof trusses, and discusses the complete designs for a single-track railroad bridge and highway bridges, and, with Prof. Johnson, trestles and elevated tracks. Mr. J. W. Schaub, who has long been in charge of bridge works, considers the theory and the practical design of swing bridges. Mr. D. A. Molitor considers the esthetic design of bridges and Mr. C. T. Purdy iron and steel tall building construction, being practically qualified for this work. Mr. George H. Hutchinson contributes a chapter on iron and steel mill-building construction. Specifi-

cations, processes of manufacture, inspection and methods of erection are treated by well qualified writers in the chapters of the appendix.

The duty of the editor has been well performed, for there are fewer differences in statement and form and there is less repetition than might be expected in a book, in the construction of which so many had participated.

Proceedings of the Thirteenth Annual Meeting of the Iowa Engineering Society, held at Davenport, Ia., Jan. 16-19, 1901, 114 pages, paper, 50 cents. T. R. Warriner, Secy., Cedar Rapids, Ia.

This publication is a year late in its appearance, but has some interesting papers on engineering work in Iowa, water analysis, water works, electric street lighting, mineral deposits in Iowa and surveying.

Annual Reports of the War Department. Report of the chief of Engineers, parts 1 and 2, 1,750 pages. G. L. Gillespie, Brig.-Gen., Chief of Engineers, Washington, D. C.

The first volume contains the report of the chief of engineers and appendices showing the progress of work on fortifications, the condition of engineer schools and posts and work in the Philippines. The second volume contains reports from various engineer officers in charge of river and harbor improvements and other engineering work. A slight examination of the volumes has not brought to light any points to which special attention need be called. Three more volumes are to follow.

Legal Decisions, third series. Arranged and complied by Peter Milne, secretary American Water Works Association, New York City.

This series of abstracts of decisions in cases of interest to the members of the association contains about thirty pages, including a few pages giving the points of interest in several arbitration cases involving sale or condemnation of plants or fixing of rates. The decisions are arranged under the general headings of water and water courses, municipal corporations, eminent domain, and constitutional law. Most of the decisions quoted are in the forms of paragraphs from the syllabi of the cases, but a few are given quite fully.

The Asphalt and Bituminous Rock Deposits of the United States. By George H. Eldredge. Extract from the twenty-second annual report of the U. S. Geological Survey. Charles D. Walcott, director, Washington, D. C.

This report, published in advance of the full report, goes into considerable detail in the consideration of asphaltic deposits in this country. It first makes a careful classification and definition of the various mineral hydro-carbons and allied substances, with analyses, and then considers the geological distribution of the various deposits, their origin and method of occurrence, illustrating with geological sections and maps the descriptions of strata, quarries, springs and other methods of occurrence. The California deposits are evidently the most important, but proper space is also given to those of Utah, Indian Territory, Kentucky and other states. Extracts from the report and abstracts of its descriptions will be found in our pages from time to time.

Select Plans of Engineering Structures for Railroads and Highways As Actually Constructed, Dimensions, Quantities and Cost. By Richard B. Osborne, C. E. $6. Queen & Co., Philadelphia, Pa.

This is a set of about 35 pages of plans and detail drawings of stone arches as built for railroads and highways, the size of drawings being 12 by 18 inches. It is a very valuable collection of data for straight and skew arches of various spans, loads and foundations which will be an excellent guide for engineers engaged in similar work. The book was published some years ago and is just as valuable for the class of work described as when it first appeared.

Asphalt Investigating Committee's Report.

The bondholders' committees of the National Asphalt Company and the Asphalt Company of America met separately March 27 and considered the report of the Audit Company of New York. It seems that, although the fixed charges of the companies were $2,150,000 a year, the actual net earnings of the past two years have averaged $350,000 a year. Extraordinary expenses in Venezuela and losses of some subordinate companies are said to account in part for the discrepancy. The National Contracting Company is one of these subordinate organizations which is said to have lost $500,000 on its work in New Orleans and elsewhere. The investigation will be continued further to ascertain the reasons for the excessive overcapitalization.

The Streets of Wilmington, Del.

Several of our illustrations this month show views of the beauties and the recent public improvements in Wilmington, Del. We are indebted to Harvey J. Wiley, the secretary of the street and sewer department, for them. Special attention may be called to the view of Delaware-ave. and the high school, a building which has recently been erected at a cost of $200,000, and to the view of

the Farmers' market taken from Mr. Wiley's office window. This market has been in existence since the days of the Indians in Delaware, and is highly appreciated by the householders of Wilmington.

North Peoria Improvements.

A tract of eighty-six acres adjoining the city parks of Peoria, Ill., is under improvement this year, contracts for sewers and pavements being let from time to time, as noted in our department of "Improvement and Contracting News," by the Briggs Real Estate Company. The area has been sub-divided, 100-foot boulevards with grass plats down the center being improved with six-foot cement walks adjoining the cement curb and gutter and asphalt driveway. Shrubbery, trees and grass in abundance are provided for. Sewers, water mains, and wires are run in the alleys in the rear of lots and all these improvements are made before the lots are open for construction of buildings. The accompanying illustration shows the appearance of the work, being a view of a boulevard in Schenectady, N. Y., constructed a year or so ago on the same plan.

A NEW BOULEVARD IN SCHENECTADY, N. Y.

Sewers and Sewage Disposal at Fond du Lac, Wis.

The city of Fond du Lac, Wis. has recently completed a system of sewers and a plant for the purification of the sewage Intercepting sewers were built to take the house sewage flow from the existing sewers and lead it with the discharge from new sewers to the pump well, from which it is elevated to the septic tanks, whence it overflows into a novel carrier six feet wide and three feet deep nearly filled with cinders placed about a twelve-inch pipe laid in the bottom with open joints. This pipe leads to a gate house from which the partly filtered sewage is led either over the surface or from below upon cinder filter beds. An illustrated description of the plant, which has some

interesting features, is in preparation for publication as soon as a report can be made of the early action of the beds. Mr. George S. Pierson is the designing engineer and Mr. Irvine Watson the engineer in charge of construction.

Municipal Reports.

Civil Report of Major General Leonard Wood, Military Governor of Cuba. Volume xii. Report of Major W. M. Black, Chief Engineer, Department of Cuba, for the Six Months Ending December 31, 1900. 425 Pages and Many Drawings and Photographs.

The public works of Cuba are in part under the department of public works under the secretary of public works, and in part under the engineer officers of the military government. The city of Havana is under the engineer officers, and some isolated works throughout the island have been in charge of acting engineer officers under department commanders. Lieutenant W. J. Barden, Corps of Engineers, U. S. A., is Chief Engineer of Havana, and most of this report is of the work under his charge. The history of the annulling of the Pady contract for paving and sewering Havana and of the new specifications and contract through the period covered by this report is given.

The work of the acting engineer officers outside of Havana included works for the military detachments, in quarters, water supply, roads, warehouses, and in street paving and sewerage, drainage, bridges, wells, street cleaning and all sanitary improvements in the towns and country districts in their charge. Puerto Principe, Matanzas, Cienfuegos, Santa Clara, Quemados, Santiago, Manzanillo, Holguin, Baracoa, San Luis are the headquarters of the various officers reporting. The character of the work is shown by many reproductions of photographs showing conditions before, during and since work was done.

The report upon Havana covers 250 pages and is an epitome of the latest practice in all lines of municipal and sanitary improvement. The work is well organized in departments, having charge of the office, the finances, property, streets, street cleaning and parks, water and sewers, sanitation and repair of public municipal buildings, architecture. The report of each head of department goes into detail and is illustrated lavishly.

No better method of showing the development of the city could be devised and the distribution of this report would be the best advertisement the new Havana could have. It should have a binding, however, which would permit of opening the book without breaking it in two.

City of Chicago. Statistics, January, 1902. The Chicago Municipal Library and Bureau of Statistics, 200 City Hall.

This number contains the totals for the year 1901, for each month of the year and for 1900. A few of these totals will be of interest. The total of lineal feet of streets cleaned during the year, counting as a single cleaning, was very nearly 100,000,000. One and one-third million cubic yards of garbage were removed. The city used 126,664 million gallons of water, an increase over 1900 of 8,766 million gallons. Nearly 11,000,000 was the average daily candle-power of light used for public purposes, costing $754,680. There was an increase of 434,000 average daily candle-power and a decrease of $152,000 in cost over 1900.

The appendix gives statistics of number of police officers and salaries in ten cities, the annual report of the bureau and a summary of the city's expenditures for 1901. Street cleaning cost $370,200.84 for 18,921 miles. Garbage removal cost $490,302 for quantity given above. Repairing improved streets averaged 72 cents a square yard of streets repaired. There are 1,346 miles of pavements, 30 per cent. being macadam, 55 per cent. cedar and 8 per cent. asphalt. The total mileage of streets is 4,163. There are 1,500 miles of sewer costing $255,411 for maintenance; 302 miles were cleaned at an average cost of $91.37 a mile. Of the 54,250 catch basins 10,037 were cleaned at an average cost of $3.27 for each cleaning.

Annual Report of the Light and Power Commission of Marquette, Mich., for the Fiscal Year Ending March 11, 1902. J. E. Sherman, Secretary.

This is a plant about 13 years old, which earned $32,580.63 during the last year, sold bonds for $9,915 and had total receipts of $52,673.06. It paid $11,347.95 for new construction, $14,479.61 operating expenses, $11,000 bonds and debt to general fund, $3,367.50 interest, $8,340.13 shop material and labor and increased its cash on hand $1,853.04. Some further discussion of the figures in the report will be given later.

Annual Reports of the City Engineer, the Superintendent of Parks and the Health Officer of the City of Mankato, Minn., for 1901. J. R. Thompson, City Engineer.

The reports of cost of sewers are carried forward from year to year so that each report gives full information for each year of construction. Last year $575.05 was expended. There was a decrease of 27 million gallons in the total pumpage of water, due, it is thought to the insertion of 62 additional meters, making 146 in all, for 1,003 water takers. The receipts were $13,370.44, $1,399.28 of this

amount being the proceeds of the "five-cent frontage tax." The expenditures were $11,096.32, making a profit of $874.84 without counting the frontage tax. Interest payments amounted to $4,005, but there is nothing charged for sinking fund or depreciation. The city receives free all water for public purposes which, at regular rates for water used and $35 for hydrants, amounts to $7,915, so that the city can well afford to take care of the bonds from its general funds. For the average daily consumption of 907,000 gallons the cost of pumping is $15.56 per million gallons; of maintenance and operation is $20.60, and of total expense, including also interest on bonds and cash investment and depreciation, is $50.06. The head on the pumps is 223 feet.

Over 3½ miles of cement walks were laid during the year. The street department cost $15,350 to the city and $2,130.76 to property-owners, less than $3,000 of the total being for new construction. Street sprinkling in Front-st. cost 25 cents per 100 feet per week for 27 weeks, or 4.9 cents per front foot; for the rest of the city 16 cents, or 3.5 cents per front foot.

Parks cost about $3,600 for maintenance. The report has a number of views of the beauties of the park system, which seems to be on a somewhat larger scale than is usual for cities of 11,000 inhabitants. The health officer constructed a temporary bath house in June and reports its use by an average of 175 persons a day during the season. He recommends the establishment of a permanent bathing place for summer use.

Third Annual Report of the Board of Water and Light Commissioners of the City of Duluth, for the Year 1901. L. N. Case, Manager and Secretary.

This department operates the water and gas plants of the city. Special attention should be called to the full and clear methods of stating, in condensed, yet detailed, form the expenditures and the receipts, with such classification of items that the condition and economy of operation of the works is readily ascertained. The total earnings of the works for the year were $174,901.83, and the total expenditures for maintenance, operation and interest were $167,475.84, of which $111,478.30 was for interest, leaving a surplus of $7,425.99. Construction cost $41,026.77 and $11,305.50 was received from tax levy. A loss of revenue of $27,917.89 for the year was suffered by the large reductions in gas and water rates which took effect Jan. 1, 1901—more than sufficient to make up the difference between total expenditures, including construction, and total receipts. The city is apparently proceeding upon the principle that public uses of gas and water should be paid for out of public funds and that the profits of the operation of the works should be divided with the consumer by reducing rates. The saving to consumers by reductions in rates since the works were taken by the city, Aug. 1, 1898, has been about $111,000, and the works have also paid $165,900 interest on the supplementary system which has been constructed to obtain pure water.

The cost of pumping water for the year against the head of 295 feet has been $4.12 on the basis of the coal consumed, $8.62 on the basis of pumping station expenses, $17.18 on the basis of all operating expenses, and $85.59 on the basis of operating expenses an interest. Were sinking fund and depreciation allowances made the cost would be still further increased. Apparently a system which is economical in operating expenses, has been constructed, but the first cost of the system has been quite large in proportion to the present consumption.

Eighth Annual Report of the Commissioner of Public Roads of New Jersey, for the Year Ending Oct. 31, 1901. Henry I. Budd, Commissioner.

The report states that 109 miles of road were built and paid for in 1901, the largest amount since the commission was established in 1893, except 1899, when 114.7 miles were constructed. About 35 miles more were built and not paid for during the year. Of this amount 109 miles, costing $450,000, were built under the state aid law, one-third of which was the amount appropriated and the proportion due from the state under that law. Under the state aid law 641 miles in all have been built at a cost to the state of $1,015,168. Petitions are on file for the construction of 424 miles at an estimated cost of $1,676,000. Stone cost from 50 to 75 cents a ton at the quarry, freight varied from 0 to 80 cents and cartage from 20 to 50 cents a ton.

The average cost of stone roads per mile is said to be from $5,000 to $5,500. The average for all roads, including gravel and shell, is $3,750.

The usual reproduction of specifications, road laws and estimate tables fills a number of pages. Some consideration of particular roads will be given later.

Seventh Annual Report of the Board of Public Works of the City of Little Falls, New York. E. T. Lansing, City Engineer.

This board publishes every voucher and receipt in the order in which it is drawn, but makes it easy to place them all in their proper relation by ruling the pages in four columns, headed contingent, park and cemetery, highway, and waterworks, receipts being placed on the left-hand page and payments on the right-hand page, and months being kept together. This statement, which occupies twenty-six pages for the account of about $58,000 receipts and $55,500 expenditures, is followed by a detailed separation of the vouchers for expenditures for water works, so that the amounts spent on conduits and reservoirs, extensions of distribution, maintenance, reconstruction, etc., are quickly found. The same is done for the highway expenditures. The detail and the classification should be eminently satisfactory to the taxpayers of Little Falls and furnish all that any one could ask in the way of information regarding the financial operations of the city.

The city engineer's report furnishes the text explanatory of the operations whose skeletons are shown in the tables referred to. The city has extended its system of water supply and has had much experience recently in determining and settling riparian rights for storm water impounded, some of which is detailed. The remainder of the report is taken up with the detail of the small expenditures in street repair and improvement, and street, sewer, water works and cemetery maintenance.

Annual Report of the City Engineer, Cambridge, Mass. L. M. Hastings, City Engineer, 20 pages and 2 plates.

The city engineer's office has apparently done much work for the street, sewer, park and water works departments and for miscellaneous purposes, besides a small amount for private parties, at a cost of about $11,000. The refusal of the state board of railroad commissioners to approve a grade crossing of the proposed street railway and an existing railway apparently gives an opportunity for the first step toward the solution of the grade crossing problem upon which Mr. Hastings made a detailed report last year. A set of detailed maps of the city in sections, showing all underground structures in the streets is under way. There are many complaints of insufficient sewerage in various sections of the city. Sewers are constructed under several different systems, and the report is not very clear in separating them. The city seems to have paid during the year $72,345 for the maintenance, operation, sinking fund and interest of the metropolitan sewer, which serves as outlet for so many of the sewers in Boston and the adjoining towns and cities. For construction it paid $9,740 for general sewer construction, $76,546 for improved sewerage and $18,929 for maintenance. A parkway along the Charles river is under construction by the park department.

Fifth Annual Report of the Board of Trustees, Commissioners of Water Works, Cincinnati, O., Jan. 2, 1902. August Herrmann, President; G. Bouscaren, Chief Engineer.

This report is made upon the same principle as that of the board of public works of Little Falls, N. Y., noticed elsewhere, except that the first statement of receipts and expenditures is not separated into different funds, all being for construction of the new water works. The classification of expenditures shows the same admirable plan which is in use in other departments of the city of Cincinnati and makes a study of the progress of the work and the cost of its various divisions easy and satisfactory. The chief engineer's report furnishes the needed commentary and diary of the progress of each contract. Thus far 29 contracts have been let upon which $1,313,416.19 has been paid. Fifteen contracts have been completed, three have been annulled and two involved payments to the board. Bonds to the amount of $2,850,000 have been issued on which premiums amounting to $66,478 have been received. The needs of the board for more money were set forth in a communication to members of the legislature which has been noticed elsewhere.

Good Roads in Indiana.

The Indiana State Board of Commerce devoted one session of its annual meeting held February 18 and 19 to the subject of good roads. Discussions of the general economic and engineering features of the subject were presented by C. W. Sherritt and C. M. Kimbrough of Muncie, and a consideration of the cost and the items entering into it was given by Charles Carroll Brown of Indianapolis. An abstract of Mr. Brown's talk follows:

The cost of a road depends upon the

traffic to which it must be subjected. The amount and kind of traffic determine largely the width, kind and depth of paving material. With reference to this, roads may be divided into three classes: (1) Main roads between populated centers are numerous in some sections of the East, but very few in Indiana. A New Jersey road of Telford macadam of this class twenty feet wide and ten inches deep cost $12,641 a mile. Indiana would probably build such a road of brick or bituminous macadam. (2) Main branches are farm traffic arteries and have little or none of the traffic between cities or manufacturing establishments and shipping points. They are made of macadam perhaps of less width and depth and costing, say $5,894 a mile for a road fourteen feet wide and six to ten inches in depth. Third-class roads are those used by a small number of farmers, and may be made narrow and six to eight inches deep of gravel or broken stone. A New Jersey example cost $2,424 a mile for a road fourteen feet wide, six to eight inches thick.

The average of cost of Indiana gravel roads is $1,994 a mile, and macadam roads $2,402. The macadam roads correspond to the second-class roads, and the lighter gravel is used on third-class roads.

Width has much to do with cost, the cost of material being in proportion to width. Third-class roads need be only ten to twelve feet wide; second-class twelve to sixteen feet. Depth of road material varies the cost in the same way. Third-class roads may be six to eight inches deep; second-class, eight to ten inches.

Form of cross section varies cost. The standard Massachusetts cross section costs about $1,000 a mile for excavation, while a simple cross section just as good for third and second-class roads would cost only $430. Reduction in grade is valuable, but not to the extent sometimes stated.

Some increase in cost on account of better material is economical; thus if the ease of traction on a macadam road is compared with that on a gravel road, at least a third more could be paid for a macadam road to advantage. The Indiana macadam roads, figures given above, are more economical than the gravel roads, if measured in this way.

Drainage is an essential, and at least six inches a hundred feet must be obtained as the fall in the ditches. If the grade is more than two feet in a hundred, the ditches must be paved at some additional cost.

Ease in getting materials is one item of difference in cost. Thus, White county gets macadam roads at $2,700 a mile, while Porter county must pay $3,100 for gravel and $3,900 for stone with gravel surface.

Bituminous macadam, which is a macadam pavement bound together by a specially prepared tar or asphalt filling, is a valuable material for first-class country roads and city streets of light travel. Cost of materials cut a large figure here, also. Thus, in Huntington, where broken stone costs 75 cents, a bituminous macadam costs $1.27 a square yard, while in South Bend, where stone costs $1.80, the same pavement costs $1.75.

Cost of maintenance enters into the cost of good roads. Where first-class roads require a man for every two miles, a third-class road can be kept up by a man on every six, eight or ten miles, and when the cost of keeping him at work is compared with the present system of road repair, there is little difference in cost and the vast difference in quality of road surface.

Problems of Municipal Government.

Mayor Head of Nashville, Tenn., recently delivered a lecture upon some of the problems of municipal government at Vanderbilt university, and showed that Nashville is struggling with the same problems which are under discussion in every other city of the country. He shows the need of better principles upon which to base legislation and greater centralization of responsibility.

Mr. Head mentioned the fact that the municipality was unforeseen and unprovided for by the founders of the federal constitution, and that as it had no rights given it by that instrument it had to get them from the legislatures of the several states, which were as a general thing composed of men who did not understand city government. This made it difficult to get proper legislation and the right to do those things which a city must have to provide local self-government for its inhabitants. He said that often legislative grants to municipalities were incomplete, and cited as an instance an act of the general assembly of Tennessee which years ago gave cities the right to manufacture electricity for their own use, but made no provision for their selling light and power to private parties or other consumers. This defect made it necessary to

go to the general assembly for subsequent legislation to secure this right.

He mentioned as some of the mistakes of municipal government the granting of long-time franchises to private corporations, and said that because of these grants in the city of Nashville his administration had been hampered. He said that it had been extremely difficult for him to accomplish anything in the way of legitimate reforms because of the old contracts in existence at the time of his induction into office, and that most of his time had been spent in straightening out the complications that arose from these contracts.

While discussing franchises he told of the expiration of that of the Gas Company and of the new one he had compelled them to accept, which ran for twenty-five years and contained a provision that the city could purchase the plant at the expiration of a certain time should it see fit to do so.

The Mayor took up the local street car problem and discussed those phases of it which are familiar to the local public. He went into the history of the grants to the several companies that have operated here from the first to the present time, and told how the matter had become complicated and had gone into the courts.

Mr. Head discussed the water works system of the city and criticised the management for charging the water used to consumers alone. He said that the city should be charged up with the water it used, and that the cost of supplying water to a municipality should be paid by public taxation and not by the consumers.

In his concluding remarks the Mayor touched briefly on municipal ownership of all natural monopolies.

Opinion on Septic Tanks for Large Quantities of Sewage.

The state sewerage commission of New Jersey has been making a study of the methods of disposing of the sewage of the lower part of the Passaic river from Paterson down. A plan for the upper position of the district was prepared by C. R. Wise of Passaic, R. M. Watson of Rutherford and William Ferguson of Paterson, and one for the lower portion by James Owen of Newark. These plans were referred to Rudolph Hering, J. J. R. Croes and W. M. Brown, jr., and the resulting plans are presented to the legislature with request for power to carry them out at the expense of the communities interested. They propose a trunk sewer 15.7 miles in length and 7 feet in diameter at Paterson and 11½ feet at Newark Bay, with its bottom about 25 feet below mean high tide. Here the sewage would be lifted about 40 feet by pumps, forced through two 60-inch castiron force mains across the bay to the Bayonne shore, whence it would flow through about 13,000 feet of outfall sewer into upper New York bay about two miles from shore. The cost for the entire project is estimated at $7,000,000.

In support of this plan as better than one proposing sewage purification the board of experts says:

The only alteration is, as before stated, partial purification by works on the Newark meadows. A sufficient purification can be effected, as has been proposed, by septic tank treatment followed by contact beds, provided a sufficiently large plant were installed. The cost of this method, particularly when applied to large quantities of sewage, is still a matter of doubt, arising from a lack of sufficient experience with operation on a large scale. We are somewhat uncertain as to the quantity of sludge which will be deposited in the present case and require mechanical removal. The length of time during which sewage of the character and strength here expected should be subjected to septic action ranges between ¼ and ¾ day. There is also still some doubt as to the best preparation of the tank effluent for the contact beds, the life of the latter and the best details of operation.

"No bacteria have yet been discovered which will consume mineral matter," says Mr. Gilbert Fowler, the superintendent and chemist of the Manchester, England, sewerage works. "Grit chambers," or catch pits, he considers essential before passing the sewage into the septic tanks, the size of such catch pits depending upon local conditions. "If the catch pits are too small all the grit will not be arrested; if too large, sludge, which might otherwise have been bacterialized, will be taken away with the grit." There being in the Passaic sewer district several square miles, which are now sewered on the combined system, and therefore admitting surface water, a large amount of grit will necessarily be conveyed to the pumping station, and this, to insure proper septic action in the tanks, should be separated by deposition before entering the tanks.

The amount of sludge deposited in the tanks varies with the character of the sewage, and, according to Mr. Clark, would range in different cases from 30 to 80 per cent. of the total suspended matters, the higher figure being for very strong sewage. Under conditions to be expected in the Passaic valley, he estimates that not less than 40 per cent. of the total suspended matter would be deposited in the tanks.

Part of this deposited matter would be liquefied by septic action, and part of it would have to be removed by mechanical means. The latter portion would approximate 30 per cent. of the total amount suspended in the original sewage, and, with a population of 600,000 people contributing to the sewers as existing in the Passaic valley, upward of 90,000 tons of

wet sludge might have to be removed annually from the tanks.

As to the so-called contact beds or filters of broken stone, through which the effluent from septic tanks must be passed, it is our opinion, confirmed by Mr. Clark: "That the greatest permanent rate of filtration through contact beds of the best construction, meaning by this, contact beds of material giving the best results and rates that can be maintained for a number of years, is not more than 800,000 gallons per acre per day, and perhaps not over 600,000 gallons per day." The above rates refer to a "single contact" treatment of the effluent in the septic tanks, in beds of from 3 to 4 ft. in depth. If beds of double thickness were provided, say about 7 ft., it seems for present purposes to be feasible to increase the rate to about 1,000,000 gallons per acre daily. This is in accord with recent English experience, when we recognize the fact that the effluent of septic tanks in England contains much more organic and suspended matter than there would be in the case under consideration.

It will be necessary, therefore, to construct at the first works capable of purifying 100,000,000 gallons a day, after being pumped:

(1) Settling tanks for the deposit of the grosser mineral impurities held in suspension, from which the effluent will flow into

(2) Septic tanks of at least 50,000,000 gallons capacity and 8 ft. deep, arranged to empty upon

(3) Contact beds of broken stone of perhaps 167 acres in area, underdrained at the level of the highest tides.

As regards the cost of maintenance, there is uncertainty as to the kind and quality of water which would accumulate in the contact beds. In order for these beds to perform their function, it is necessary that the stones composing them should be covered with a slime, which requires considerable time to form and which accumulates to such an extent in the course of time as to diminish materially the capacity of the beds. The rate of this accumulation varies with the character of the sewage; it has been observed at some English cities that the accumulation was at a rate to diminish the capacity of the bed 50 per cent. in one year, while in other cases the diminution has only been 33 per cent. in three years. When the capacity of the bed is materially diminished, it is necessary to remove the accumulation by washing the bed with water. The frequency of such washing, its cost, and the extent to which it should be carried are as yet indeterminate for contact beds, judging from their actual service, which in one case has been as long as eight years, but not under comparable conditions.

It is necessary in the operation of a septic tank that there should be some sludge on the bottom and also a coating of sludge on the top. Where the surface is exposed to the wind, the formation of this surface sludge proceeds very slowly, and instances have occurred where a well formed surface has been suddenly dissipated by a gale of wind, and the process of formation has had to be repeated; the uncovered sewage may in the meantime give forth offensive odors.

It is not practical, therefore, at this time to make any close estimate of the cost of maintenance of the septic tank system applied to the purification of 100,000,000 or 200,000,000 gallons per day with any assurance that the cost in practice would correspond with the estimate.

The cost of the disposal plant necessary for the purification of 100,000,000 gallons per day, which is as much as should be provided for in the first disposal works to be built, may be approximately estimated and is about $4,500,000, including 300 acres of land, uncovered septic tanks, contact beds and two sludge boats to carry the sludge to sea. Covered tanks would correspondingly increase this sum.

The cost of construction of an outfall sewer to discharge 100,000,000 gallons daily from the pumping station to deep water near the center of New York bay, would be about $2,500,000, with practically no operating charges. The great economy of the latter project is, therefore, apparent, and we have no hesitation in recommending it to you for adoption. It is not only much the least expensive of the possible solutions of the problem before you, but it is a final solution.

The estimate of cost of the sewers for the daily collection of 270,000,000 gallons of foul water from the Passaic watershed and of its discharge into New York bay, as hereinbefore outlined, is as follows:

82,900 ft. of sewers from 7 ft. to 11.5 ft. diameter	$3,950,000
Pumping station at Wallington	50,000
Pumping station at Newark Bay	500,000
Outfall pipe for discharging 100,000,000 gallons daily from the west shore of Newark Bay to deep water in New York Bay	2,500 000
Total cost excluding cost of land	$7,000,000

Uniform Municipal Accounts and Statistics.

The committee on uniform municipal accounts and statistics of the National Municipal League held a meeting at the Shoreham, Washington, D. C., recently. The question of inaugurating a basis for all cities of the country to keep their accounts so as to enable the students of municipal affairs to compare the cost of municipal government and the operating municipal franchises was discussed.

The conclusions of the committee's report were submitted to the American Economic Association at its sessions at the Columbian University. The conclusions are:

1. That the interests of good municipal government, economics and public finance demand the collection and publication of state and national municipal statistics.

2. That such statistics, to be of service, should be based on uniform municipal accounting.

3. That, as a rule, American municipal accounting is in a most deplorable condition, being unsystematic, incomplete and misleading, with little correlation between the accounts of different departments of the same city, and the utmost diversity in the accounts of different cities, rendering comparison of the working of different departments and cities always difficult and often impossible.

4. That certain mooted questions of public policy, like municipal ownership, and day labor as compared with the contract system of executing public work, can never be thoroughly or properly studied until greater uniformity in municipal accounts and reports has been secured.

5. That co-operation between the various economic, sanitary, engineering and other technical society interested in or devoted to municipal affairs, or some branch thereof, should be encouraged, to the end that uniform schemes for municipal accounts and reports, covering the various municipal undertakings and interests, whether in public or private hands, may be formulated and adopted.

6. That after the formulation and adoption of these schemes by such co-operative efforts, it is desirable that steps should be taken to put them into use by the various municipalities of the country, either under the direction of state boards of municipal control, or special state commissions for different classes of undertakings and interests.

7. That a yearly comparative summary of the municipal statistics of the whole country, made and published by some branch of the national government, would place much valuable information within the reach of many investigators, to whom it would otherwise be unavailable, through lack of time to compile it, or through the impossibility of securing the many necessarily scattered reports.

8. That the summary of statistics for cities of 30,000 and upward, compiled and published by the United States department of labor in 1899 and 1900, should be continued, pending improvements in municipal accounting, and that the present census office should make an exhibit showing the nature and general extent of municipal activities (a true census, or count) which would serve as a basis for more detailed inquiries after the organization of a permanent census or other statistical bureau, with a staff of experts in municipal engineering, sanitation, vital statistics and sociology, finance and economics generally.

Personal Notes.

Harry E. Tibbetts has been elected city clerk at Saco, Me.

Charles H. Cole has been elected town clerk at Kennebunk, Me.

E. A. W. Chenoweth was elected town clerk at Atlanta, Ill., March 17.

Malcolm D. Patterson has been elected city engineer at Northampton, Mass.

Timothy E. Walsh has been appointed superintendent of sewers at Woburn, Mass.

The Hon. Louis Walther, mayor of Georgetown, O., committed suicide March 6.

Capt. G. G. Shepardson, former mayor of Paxton, Ill., died March 19 of apoplexy and paralysis.

Henry Martin, a manufacturer of brick machinery, Lancaster, Pa., died March 4, aged 70 years.

Walter Roberts has been elected president of the Alexandria Water Company, Alexandria, Va.

Samuel Parsons, jr., has been appointed landscape architect to the park board of New York City to succeed John DeWolf, resigned.

Jacob Cloos has established an office at 1001 Pabst building, Milwaukee, where he will practice as consulting electrical engineer.

The Hon. P. B. Lynch has been elected mayor, T. J. O'Hara city clerk and J. H. Fitzgerald commissioner of public works at Vallejo, Cal.

C. A. Stewart of East Pittsburg has been appointed borough engineer of Wilmerding, Pa. C. C. Cowell was re-elected borough clerk.

W. B. Patton has been reappointed city engineer, and C. W. Wilson has been appointed a member of the board of public works, at Duluth, Minn.

William T. Lyle, Assoc. M. Am. Soc. C. E., has established an office at 792 Broad-st., Newark, N. J., where he will practice civil engineering.

Fred Eaton, M. Am. Soc. C. E., ex-mayor of Los Angeles, Cal., has been appointed consulting engineer of the municipal water system.

Robert M. Simmie, assistant water works engineer of London, Ont., has been appointed chief engineer of water works to succeed the late Alexander Findlay.

W. C. Kirkland, first assistant engineer of the drainage commission of New Orleans, La., has temporarily succeeded Benjamin M. Harrod as chief engineer.

Leonard W. Rundlett, M. Am. Soc. C. E., formerly city engineer of St. Paul, Minn., has been again appointed to that position after an absence of three years.

Louis M. Krebs has been appointed superintendent of public works at Newport, Ky., to succeed W. L. Glazier, who resigned to become superintendent of the water works.

Charles Caldwell, city engineer of Newburg, N. Y., and who has been in the city's service for thirty-nine years, recently resigned his office and is in Bermuda for his health.

O. G. Smith of the air compressor department of the Stillwell-Bierce and Smith-Vaile Company, Dayton, O., has been appointed to succeed P. B. Fenlon as manager of the company's Philadelphia office at 612 Arch-st.

Gen. Augustus P. Martin, water commissioner of Boston, Mass., and former mayor of that city, died at his home in Dorchester, Mass., March 13. Eugene S. Sullivan has been appointed to fill the vacancy.

George L. Tribus, M. Am. Soc. C. E., and Charles G. Massa, C. E., have formed a partnership under the firm name of Tribus & Massa, and will prac-

tice as consulting and supervising civil and hydraulic engineers, with offices at 84 Warren-st., New York City.

George W. Tillson, M. Am. Soc. C. E., principal assistant engineer of the department of highways, Brooklyn, N. Y., has been appointed engineer of that department, succeeding Nelson P. Lewis, M. Am. Soc. C. E., who was appointed engineer of the board of estimate and apportionment.

A. Gould White, city engineer of Wellsville, O., has been appointed chief engineer for the American Sewer Pipe Company, whose principal office is at Pittsburg, Pa. Mr. White has engaged Robert H. Russell of Sayre, Pa., who was connected with the Lehigh Valley railroad, to take charge of his outside work.

John Ericson, city engineer of Chicago, and Karl L. Lehman have formed a partnership under the firm name of Ericson & Lehman, and have established offices at 604 Chamber of Commerce building, and will make designs and furnish specifications for water works, power stations, sewers, subways, bridges, viaducts, elevated railways, etc.

Frank Conger of Brooklyn, N. Y., died suddenly at the Wayne hotel, Detroit, Mich., March 8, of pneumonia, aged fifty-two years. He was on his way to Little Rock, Ark., from Saginaw, and was taken ill on his arrival at Detroit. Mr. Conger was the founder the American Bridge Company, which was absorbed by the United States Steel Corporation.

Carl A. Bostrom of the Osborn Engineering Company, Cleveland, O., was awarded the MacDonald prize of the net annual income of the invested fund of $2,000 for the best thesis of the class of 1901, Rensselaer Polytechnic Institute. The title of the thesis was "Design for the Development of the Water Power of the Potomac river at Great Falls, Md., for Electrical Transmission to Washington, D. C."

Alvord & Shields, sanitary and hydraulic engineers of Chicago, Ill., dissolved partnership March 1. Mr. Alvord will continue his consulting practice in matters pertaining to water powers, water supplies and appraisements, sewerage, sewage purification and financial examinations and reports, at 127 Hartford building. Mr. Shields will open an office after April 1 at 1715 Marquette building, where he will continue his practice as consulting and designing engineer for water works, sewerage and other municipal works.

Mayors have been elected as follows: Arthur W. Greely, re-elected, Ellsworth, Me.; William Engle, Bangor, Me.; Leon F. Higgins, Brewer, Me.; I. T. Webster, Atlanta, Ill.; James Ritchie, South Cape May, N. J.; Thomas Bray, Avalon, N. J.; Augustus Hilton, Anglesea, N. J.; Latimer R. Baker, Wildwood, N. J.; Frank E. Smith, Holly Beach, N. J.; Walter B. Edmunds, West Cape May, N. J.; D. J. McGillicuddy, Lewistown, Me.; Eben G. Eveleth, Auburn, Me.; Joseph Gooch, Biddeford, Me.; Dr. G. Spencer Purdy, Seneca Falls, N. Y.; William Freeman, Saco, Me.

MACHINERY AND TRADE.

Street Lighting a Science.

Street lighting is a science which demands the best efforts of the inventor and manufacturer in developing the maximum candle-power with the minimum consumption of fuel, which requires good material and skilled mechanics as well as the expert knowledge of the designer. The word candle-power is one whose significance but few public officials fully appreciate.

As a matter of fact, candle-power is deceptive. It requires an expert to tell within twenty candle-power the brilliancy of a light above forty candle-power. As to the lighting area of a forty or sixty candle-power light, there is little or no difference. It would be idle to deny that a sixty candle-power light would not light a given space with greater brilliancy than a forty candle-power light would, but with posts set at 200 to 300 feet apart, the rays of light intermingle, illuminating the space between the lamps. A forty candle-power light, gas or gasoline, according to some city officials, fulfils all the requirements of illumination; i. e., to make dark spots light. While sixty candle-power makes dark spots lighter, it is seldom of sufficient value to pay for the expense and trouble necessary to secure it.

The normal candle-power of gasoline or gas incandescent mantle street lamps is about forty. By normal candle-power is meant the maximum of light with the minimum consumption of fuel. Under pressure and other abnormal conditions 400 to 500 candle-power can be attained. To do so means an increased consumption of fuel which must be taken into consideration in the item of cost. Normal candle-power may be likened to the normal speed of a vessel which is, say twelve to fourteen knots an hour. To increase it to eighteen knots an hour would mean perhaps doubling the horse-power of the engine, though the excess distance gained be slight. The experts agree that similar

conditions exist in candle-power. A lamp that develops a normal candle-power of forty can be increased to sixty, seventy and even a hundred candle-power, but it takes a constantly increasing ratio of consumption of gas quite out of proportion to the results gained.

The high candle-power incandescent mantle street light is new to the city authorities. That it is efficient is not questioned. The ordinary gas street lamp with its consumption of four to five feet of gas per hour rarely gives more than fifteen to eighteen candle-power. The result is that when the mantle light is used using the gas lamps and the others gasoline lamps. Street lamps are now sold directly to city and town authorities when desired in case lighting contractors are not employed.

Sewer Appurtenances.

Several sewer appurtenances of good design are made by Kramer Bros. of Dayton, O. Special mention should be made of their castings for manholes, sewer basins and inlets and gutter crossings. They all seem to be well adapted to their purposes and in some respects superior to ordinary designs. Illustrations

THE NEW FACTORY OF THE CLEVELAND VAPOR LIGHT COMPANY.

the streets are much better lighted at a very little increase in cost.

With the growth of the demand for the incandescent mantle street light the Cleveland Vapor Light Company of Cleveland, O., has been closely identified. From its organization it has been progressive, bringing out new inventions and improvements which have been embodied in their line of lamps. Originally the firm devoted its resources entirely to gasoline equipment, but the gas line was taken on later, so that the company is in position to meet all demands in gas or gasoline lines.

Large numbers of their lamps are in use in Cleveland, Chicago, St. Paul and a number of smaller towns, the first named

of them can be found in the advertisement of the firm, which shows different views of the various appliances from month to month.

A Steel Road Scraper.

A machine which can be used to scrape the mud and refuse from any street surface, from cobble to gravel, finds plenty of chance for work. The machine made by A. B. Black of Concord, Mass., has scrapers held to their work by springs under the direct control of the driver, so that any desired pressure can be exerted. Thus the mud can be taken from a macadam street without tearing up the road surface proper. It is said that one man with two horses can clean 8,000 yards of

pavement an hour. A new macadam scraper is just ready for the market. Mr. Black also makes snow plows for opening roads and for cleaning sidewalks. Some of the sidewalk plows are adjustable to throw snow either side of the walk or to push it ahead until it must be dumped.

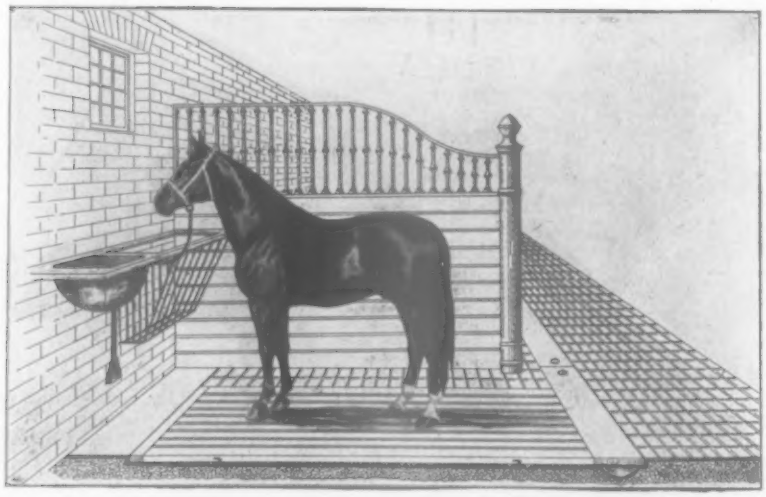
Telephones for Outdoor Use.

A telephone for outdoor purposes that will meet the requirements of many of the smaller municipalities and towns is made by the Ericsson Telephone company, 296 Broadway, New York. It should be particularly acceptable to the police departments as stations can be located in the outlying sections and connected to the office at headquarters, making an excellent substitute for an expensive and complicated police signal system, as several stations can be placed on one pair of wires, and all lines can be run on poles belonging to the telephone and telegraph companies operating in the vicinity.

The telephone consists of a hand microtelephone, magneto and two cells of dry battery and is securely encased in an iron box, which thoroughly protects the same from dust, moisture, etc., the door being securely fastened by a spring lock.

Kerosene and Gas Engines.

The application of gas as a direct motive power is somewhat limited as there must be a supply of gas. The use of kerosene for this purpose has always been attractive to inventors on account of the abundance and the cheapness of kerosene as compared with gasoline. The Mietz & Weiss engine, manufactured by August Mietz, 128-138 Mott-st., New York City, is adapted to the use of either gas or kerosene, the construction for either fuel differing only in the mechanism for injecting the fuel into the cylinder. The engine receives at full power an impulse at each turn of the crank shaft. The compression and burning of the mixture of air and fuel and the expulsion of the exhaust are all performed at a single turn in a direct and simple manner. Special attention has been given to the design of the governor and the igniter. The oil receiver for the kerosene engine, with capacity for ten hours' run, is firmly screwed to the cylinder. A simple pump forces the kerosene into the cylinder, where it is vaporized, mixed with air and ignited. The resulting pressure acts directly upon the piston to drive the engine. The applications of the engine are innumerable. Sizes from one to sixty horse-power are in regular demand.

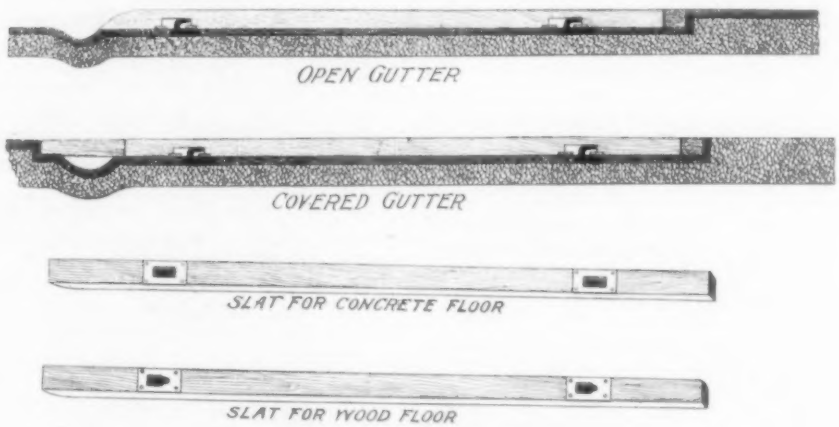


SCHOULER'S SANITARY STALL.

Concrete Floors for Stables.

One of the difficult problems of the construction and maintenance of stables, especially in cities where the natural odors of such establishments must be kept as slight as possible and removed as quickly as possible, is the floor for stalls in which horses stand. Concrete properly

mixed so as to be water tight and properly drained is ideal from the standpoint of cleanliness and durability, but is unsatisfactory from the point of view of the horse. The accompanying illustrations of the Schouler sanitary stall floor show one excellent solution of the problem. The concrete floor is first laid with proper slope to a gutter at the rear of the stall so that drainage will be perfect. A space 7 feet by 3 in the center of the stall is left at a lower level than the remainder, and in this space are set wooden slats, which are fastened down by slipping slat holders imbedded in the concrete into holes cut in the under side of the slats, and so bent as to engage with plates set part way over the holes, when the slats are slid into place. The slats are quickly removed for thorough cleaning, and with a hook the spaces between slats can be cleaned out quickly whenever desired. The gutter at the rear can be covered by an extension of the slat floor or can be left open as desired. The construction of the floor and slats is shown on one of the accompanying drawings and the completed stall on another. The Standard Paving Company, 20 Clinton-st., Newark, N. J., makes this and other stable specialties, and also constructs asphalt floors and roofing and artificial stone.



DETAILS OF SCHOULER'S SANITARY STALL FLOOR.

The Commercial Value of Advertising.

On Feb. 13 Jonn Lee Mahin delivered a lecture at the University of Chicago on "The Commercial Value of Advertising" from which quotations are made as follows:

This is an age of advertising. Within the memory of older men the ambitious youth was urged to enter the church, the army, the law or the sciences. To engage in trade was to lower social tone. Now, business is generally recognized as a world dominating science. It is becoming more intricate and complex, requiring the highest grade of intelligence.

Commerce in its elemental form is little more than the hewing of wood, the carrying of water and trading in the simple things necessary to sustain a low order of physical life. It is only when it advances to grappling with the great wheat crop of the northwest, the vast yield of cotton of the South and the products of many mines and factories that it begins to demand and give substantial rewards for the highest grade of brain power to organize equipment, devise ways and means to execute.

The problems of production and distribution, the elimination of waste and famine, the gathering together of the products of the world and setting them in order for the easy access of mankind present abundant opportunity for the highest quality of brains. Commerce in gathering and distributing, satisfied with ordinary profit and passively awaiting the result of the capricious tastes of mankind still leaves much to be desired by the mind that has real creative power.

In doing this, commerce requires the wonderful new power which the mere trader never possessed. That power with its skill, thought, resources and judgment, virile energy, largeness of mental growth and equipment, combined with a creative force that accomplishes things, is called advertising.

I have previously defined advertising as "influencing the minds of people. It is making others think as you desire. It means utilizing all those forces which produce impressions and crystallize opinions. It is the creating of prestige—that quality which causes others to accept a statement without question."

Advertising rests on the supremacy of

commerce. It requires stable business conditions for its existence and development. It is, therefore, a higher form of mental activity than the successful exercise of ordinary commercial transactions because it goes farther, in demanding not only the power to successfully cope with commercial problems, but an added ability to influence the human mind. Advertising will produce active desire where none, or, at least, only that of a latent kind existed before. Advertising, by employing the powerful mental force which psychologists call suggestion, can create well-defined habits among the people which an alert commercial mind will utilize to build up and foster a business.

The one thing that should convince the average business man who has not given much time and thought to advertising is that it has commercial value of the highest order: that it really is a higher evolution of commerce and a marked improvement on average commercial conditions, is the generally accepted spirit of restriction and protection that is placed on the use of advertising space by the owners of it, who most fully comprehend its value.

Rubber Tires for Fire Apparatus.

One of the most important applications of rubber tires to vehicles is for fire apparatus. Slipping and sliding on smooth pavements constantly menace the life and safety of firemen, citizens and other vehicles, and the rubber tire should greatly aid in diminishing the dangers of these fruitful sources of accidents. The Good Year Tire and Rubber Company of Akron, O., seem to have solved satisfactorily the difficult problems of attaching the tires so that they will not be torn off under the heavy strain to which they are frequently subjected, and the application of the brake, so that the wear on horses and apparatus can be greatly diminished as well as the comfort and safety of the men greatly increased. A handsome poster giving views of various classes of fire apparatus fitted with rubber tires and the form and method of attaching them to the wheels is issued by the company.

New Vapor Lights a Success.

In October the city of Cleveland, O., began to enjoy a contract for lighting some of its area with vapor lights, 2,500 in number, the Victor lamp of the Reserve Foundry and Manufacturing Company of Cleveland being used. Mr. C. P. Salen, the director of public works, is reported to have expressed his opinion of their success as follows, during the progress of the installation of the lights:

During the past week I have been out nearly every night to make a personal examination of these lamps. Without any question they are the finest the city has ever had. Nearly all gave a light that is far in excess of the candle-power required by the contract.

Our of 1,000 vapor lamps which I saw the other night only four were in bad condition and two were not in what could be called good condition. Not since we have had vapor lamps in Cleveland has such a showing been made. The light given by the vapor lamps is far superior to that given by the Welsbach gas lamps.

The company will soon have everything in working order and then the people will see the wisdom of the change that has been made. In one year the city will own these lamps and will only have to pay for the care of them. Thousands of dollars will be saved by this and the new gas contract.

Trade Publications.

The catalogue of brooms, brushes and street scrapers issued by the Joseph Lay company of Ridgeville, Ind., is very appropriately named the "White Wings Catalogue." It is also a price list.

The William G. Hartranft Cement Company is distributing an excellent illustration of the highest concrete pier in America as an advertisement of the Old Dominion Portland cement used in its construction, and will send it to any one on request.

The Pittsburg Blue Print company, 1505 Park building, Pittsburg, Pa., has a cylindrical electric copier for taking blue prints by electric light, the success of which, with views of the machine and price list, is shown in a circular for distribution to those interested.

The Holmes & Blanchard Company, 36 to 29 Charleston-st., Boston, Mass., issues a 200-page catalogue of its machinery and supplies for manufacturers of various articles, including crushers, mills and other disintegrators, mixers, sieves, elevators, hoists, pulleys, sheaves, belting, etc.

The Power Specialty Company, 126 Liberty-st., New York, sets forth the advantages and the applications of superheated steam in a special circular devoted to the Foster superheater.

A safe set in a deep bed of concrete is described in a circular issued by the Peck Sub-Vault Safe Company of Evansville, Ind.

Marlin repeaters are described in the 120-page catalogue of the Marlin Fire Arms Company, New Haven, Conn.

Catalogue No. 10 of the Syracuse Chilled Plow Company, Syracuse, N. Y., illustrates their line of barrows, trucks, scrapers, plows and hand carts of which the company carries a full line for business and contractors' uses. Copies of the catalogue can be obtained upon application.

The Western Electric Company of Chicago issues a catalogue of the long line of electrical appliances in use and sold by them, which, with index, covers 1,073 pages and is then said to be incomplete on account of lack of room.

Catalogue No. 56 of the Jeffrey Mfg. Company, Columbus, O., gives illustrations of their long line of elevating and conveying machinery, transmission, coal washing and mining machinery, and mill, factory and mine supplies.

Sketches of Charlotte, North Carolina, is a book of half-tones and text issued for the purpose of advertising the manufacturing, commercial, industrial and agricultural resources of Charlotte and Mecklenburg county, which contains much interesting and valuable information of a section of the South which is in process of rapid development. Copies of it can be obtained of Wade H. Harris, Charlotte, N. C.

Trade Notes.

ASPHALT.

The Russian government has ordered 100 tons of California asphalt, which has been shipped to a Siberian port, for use in public works. A shipment of 400 tons of California asphalt was lately made on account of a 5,000-ton order from Australia.

BRICK.

The Peebles Paving Brick Company has been incorporated by John Peebles, Charles W. Turner, Adam Buch, W. O. Silcox and Samuel Reed, and will erect a plant at New Boston, a suburb of Portsmouth, O. Adam Buch will be general manager.

The Metropolitan Paving Brick Company, Canton, O., has been incorporated and will engage in the paving brick business. The incorporators are: H. S. Reukert, C. W. Keplinger, W. E. Keplinger, Canton; J. J. Sullivan, Cleveland; O. W. Reulert, Akron. The new company has purchased the plant of the Imperial Brick Company, the Royal Brick Company and the plants of the Canton and Cleveland Brick Company, at Canton and Cleveland.

A new brick and tile factory is contemplated at Colfax, Ind., according to press reports.

Rockwell City, Ia., wants a brick and tile factory, according to press reports.

The Kinston-Clark Brick and Tile Company, Kinston, N. C., has been incorporated by Samuel H. Abbott, M. G. Jones, Samuel Harvey and Charles Felix Hervey.

The Kenton Brick and Tile Company, Kenton, Tenn., has been incorporated by George P. Hurst, C. A. Derryberry, P. H. Keathley Sol Shatz, B. L. Glessan and T. McDorald.

The Armstrong Brick and Tile Company, Armstrong, Ia., has been incorporated, with B. F. Robinson, president.

A number of manufacturers are considering plans for establishing clay manufacturing plants near Terre Haute, Ind. Improvements are constantly being made to increase the capacity of the two plants across the river.

The Champion City Company, Wellsville, O. ,has been incorporated and will erect a plant of 16 kilns for the manufacture of building, paving and furnace brick and electric conduits. The incorporators are T. H. Silver, Julius Goetz, Henry Cooper, Samuel Anderson and George W. Adams.

A brick and tile plant is proposed at Gowrie, Ia., by S. E. Weitzel.

The Ashton Fire Brick and Tile Company, Salt Lake City, Utah, has been incorporated to sell fire brick, tiles, sewer pipe and crucibles. The officers are, E. T. Ashton, president; George M. Cannon, vice-president; Nephi L. Morris, secretary and treasurer.

The Brookside Company, Cleveland, O., has been incorporated to manufacture building and paving brick. The officers are E. A. Wagner, president and treasurer; J. H. Craine, vice-president and manager; E. C. Plietz, secretary.

The Galesburg Paving Brick Company, Galesburg, Ill., has been reorganized, with George R. Chambers as president and James Bloomfield as secretary and treasurer. The plant will be placed in operation at once.

The Monongahela Clay Company, Monongahela, Pa., has been granted a charter. The new plant will be equipped with the most modern machinery for the manufacture of fire brick and other brick and tile. The officers are: J. McK. Speer, Pittsburg, president; J. R. Taylor, Pittsburg, vice-president; J. Ramsey Speer, Pittsburg, secretary and treasurer.

The LaHarpe Vitrified Brick Company has been incorporated with offices in La Harpe, Kas., and Oklahoma City, Ok. T. The incorporators are: J. B. Adams, D. R. Nelson, C. C. Trampton and H. M. Levan of Montgomery county, Kansas.

The Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kas., has purchased the brick works at Chanute, Kas., and will operate them in addition to its plants at Cherryvale and Independence.

William McCubbin of Brayner, Mo., a manufacturer of vitrified paving brick, drain tile, etc., is prospecting for oil and gas in his section of the state.

CEMENT.

The furnace companies at Sheffield, Ala., contemplate erecting plants for the purpose of using slag for the manufacture of cement. Outside parties are re-

ported as investigating the possibility of making cement from a rock found in great abundance near Sheffield and which is believed to be adapted to that purpose.

The California Portland Cement Company has purchased the valuable cement property near Silver mountain from the Pacific Mutual Life Insurance Company for $40,000. The purchase includes nearly 160 acres of land, a large mill, quarry and machinery, and 1,100 acres of land in the east branch of Reche canyon and what is known as the Reche canyon clay banks. The clay is especially adapted to the manufacture of cement, and is one of the largest clay deposits in the state.

The Portland Cement Company, Portland, Col., received its first shipment of machinery, consisting of three 400-horse power Heine water tube boilers March 8. The company is building its own water and sewer system, and had recently purchased several hundred acres of lime rock and awarded the contract for grading several miles of roadbed from the plant to the quarries.

A new kind of cement brick, using five parts of sand to one part of domestic cement, is being made in Alabama and also in southern California. The brick, after drying a few hours, neither contracts nor expands, and is a trifle heavier than ordinary brick.

K. Dykema & Son of Grand Rapids, Mich., are manufacturing Palmer cement blocks for building purposes. The blocks are 30x9 inches and are ten inches thick, and each block is equivalent in size to thirty bricks, but is much lighter, and, it is claimed, will save 25 per cent. in labor.

A company will probably be formed to develop the almost inexhaustible supply of cement deposit which has been formed on the plantation of J. T. Milhouse, near Selma, Ala. The deposit is pronounced the best quality from which cement is made.

The American Concrete Company was incorporated March 6 for the manufacture of cement. The incorporators are: Cornelius J. Curtin of Newark, N. J.; Bartholomew Jacobs of New York City and William J. Donaldson of Philadelphia.

The Thorn & Hunkins Lime and Cement Company, St. Louis, Mo., is succeeded by the Hunkins-Willis Lime and Cement Company. T. P. Hunkins is president and Gordon Willis vice-president and secretary.

The Hudson Iron Works, Hudson, N. Y., have been sold and will be converted into a cement plant.

The Acme Cement Company, Laramie, Wyo., which recently purchased the Laramie Plaster and Cement Company's works, is making arrangements to operate the plant on a large scale.

A new cement company is being organized by capitalists of Detroit, Mich., who have purchased 480 acres of land in Livingston county, Michigan. Experts pronounced the property as fine cement land as any in the United States. Among those interested are Arthur Pack, Homer Warren, Dr. Duff Stewart, William McGregor, Charles Wright, William E. Higginbotham and Alderman Al Doimel of Detroit and Justus S. Stearns of Grand Rapids.

The establishment of lime quarries and cement factories near Keese, Wash., is proposed.

The Wolverine Portland Cement Company succeeds the Michigan Portland Cement Company. The company, which is composed of the bondholders of the old company, will run the Coldwater and Quincy plants to the full capacity.

J. H. Young will establish a cement factory at Marshall, Minn., for building sidewalks, cisterns, etc.

O. H. Larson and Jesse Burgster have formed a partnership and will manufacture cement tiling at Jamestown, N. D.

The Chicago Cement Bag Clearing house, Chicago, Ill., has been incorporated by George H. Petring, Walter Petring and E. L. Buchanan.

The cement manufacturers of Canada have asked the government to raise the duty on cement from 12½ cents to 20 cents per 100 pounds. Also that certain minor changes be made in the regulations regarding size and shape of imported packages.

LIGHT, HEAT AND POWER.

The Federal Tool and Light Company, Kittery, Me., has been incorporated for engineering, manufacturing and trading, by Frederick Drowns, A. E. Knowlton of Madden and C. C. Smith, C. M. Prince and W. P. Huelin of Kittery.

The Amstutz-Osborn Company, 15 Exchange Place, Jersey City, N. Y., has been incorporated to manufacture electric supplies, by H. C. Osborn, H. B. Stough and P. J. Morgan.

The J. Lang Electric Company, Chicago, has been incorporated to manufacture electric machinery and apparatus, by Walter D. Hawk, Robert D. Dunn and Warren Ripple.

The Universal Arc Lighting Company, Chicago, Ill., has been organized to manufacture lamps, burners and fillings, by A. D. Eddy, J. A. Fullenwider and H. A. Dougherty.

The International Lighting Appliance Company, Dover, Del., has been incorporated to manufacture and supply gas for fuel and lighting purposes.

The Newaygo Power Company, Grand Rapids, Mich., is being organized to consolidate electric lighting and power interests. The company has purchased the Lowell electric light works, at Lowell, and the Edison company in Grand Rapids.

The American Dowsing Radiant Heat Company, Jersey City, N. J., has been incorporated to manufacture electric motors by Horace S. Gould, John J. Billings, Evan J. Dudley, I. S. Buckingham and Louis B. Dailey.

Newly incorporated lighting companies: Robertson Electric Company, Buffalo, N. Y.; Brownville Electric Light and Power Company, Bangor, Me.; East St. Louis Gas Company, East St. Louis, Ill.; Magnetic Electric Company, Pierre, S. D.; Union Gas Company, Lincoln, Neb.

MISCELLANEOUS.

The paving-stone producing companies of New York have consolidated, the combine including about thirty quarrying companies situated principally at Albion, Medina and Holley.

Brenham, Tex.—This city voted to issue $15,000, 4 per cent., bonds for the purpose of building a new brick city hall. James A. Wilkins, mayor.

The Sanders Reservoir Company, Delta, Col., has been incorporated to build a reservoir, by Sam Farmer, D. P. Cook, J. F. Sanders, C. W. Haley and D. S. Baldwin.

The Pennsylvania & Ohio Bridge Company, Conneaut, O., has been incorporated to build and maintain a bridge over Conneaut creek. The incorporators are: C. M. Traver, O. O. Lillie, B. F. Kennedy, W. C. Culbertson and Charles Marks.

The West Virginia Bridge & Construction Company has been incorporated by C. R. Hubbard, George A. Laughlin, W. C. Stone, W. A. Wilson, J. M. Brown, J. J. Holloway, J. H. Barrett and G. E. Wincher. A plant will be built at Glenn's Run, Wheeling, and will be under the management of J. H. Barrett.

The tile factory of Reischtadt & Pettit, Greenford, O., has been destroyed by fire.

A new tile factory is contemplated at Brownsburg, Ind., by a Mr. Lindeman.

The O. S. Kelly Company, Springfield, O., was given a contract for a steam road roller for the city of Toledo, O.

Messrs. Spon & Chamberlain, publishers of engineering books, after fifteen years in Cortlandt-st., are moving into more convenient quarters in the Liberty building, 123 Liberty-st., New York City.

C. O. Bartlett & Co., Cleveland, O., has incorporated under the laws of the state of Ohio as the C. O. Bartlett & Snow Company. The company has purchased a tract of land with buildings and power plant, consisting of 150-horse power boiler and engine. This property, which is situated in the central part of the city and bounded by Winter, Leonard, Sumner and French-sts., comprises sixteen lots, or one entire block. Other buildings will be added. C. O. Bartlett is president and K. F. Snow vice-president and general manager.

SEWER PIPE.

The Lockhaven Sewer Pipe Company has been incorporated under the state laws of Ohio and has purchased works at Lockhaven, Pa., which it will rebuild and put in operation.

Factory B. of the Red Wing Sewer Company's plant is being rebuilt and the plant will probably be in running order by May 1.

The Macomb Sewer Pipe Company, Macomb, Ill., has decided to expend about $30,000 in the immediate overhauling of its plant. The size of the main building and the kiln capacity will be increased and a car line two miles long will be built to the company's clay mines. The concern is now in the market for the purchase of the necessary lumber, roofing material, machinery, brick, light T rails, pit and dump cars, kilns and kiln irons, trucks, dies, barrows, fans and drying apparatus, clay screens, steam pipe, watchman's clocks, time clocks and tools and appliances of all kinds used in the business.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Brooklyn, N. Y.—The Uvalde Asphalt Paving Company and the Interstate Asphalt Company have located in this city and will compete for paving contracts.

Port Huron, Mich.—An opinion has been delivered which says that the city cannot compel property-owners to build cement sidewalks on five days' notice.

Charlottesville, Va.—The construction of an object lesson macadam road from this city to the home and tomb of Thomas Jefferson, at Monticello, two and a half miles, was begun March 24 and will be completed April 4. A good roads convention will be held in this city April 3 and 4.

Laporte, Ind.—The property-owners who are remonstrating against the paving of fourteen streets, for which contracts have been awarded, have filed proceedings in the circuit court to prevent the paving on the ground that more than two-thirds of the resident property-owners are opposed to it, and that it is an unnecessary extravagance. Judge Richter has granted a temporary restraining order until the latter can be given a hearing.

CONTEMPLATED WORK.

Waseca, Minn.—Paving is urged for Main-st.

Wellsville, O.—Jag alley is to be paved this summer.

Waseca, Minn.—Brick paving is contemplated for Second-st.

Seneca Falls, N. Y.—The question of paving is being agitated.

Vinton, Ia.—Paving is contemplated for 1½ blocks of Jefferson-st.

Rome, N. Y.—Bids have been authorized for improving N. James-st.

Reno, Nev.—Asphalt paving is contemplated for one of the main streets.

Manchester, Conn.—Plans are being prepared for macadamizing Main-st.

Stillwater, Minn.—Main-st., from Chestnut south, is to be macadamized.

Stanford, Ky.—The city council contemplates paving the streets with brick.

Morristown, Tenn.—This county voted to issue $50,000 to build county pikes.

Evansville, Ind.—The property-owners on Oakley-st. have petitioned for asphalt paving.

Harvard, Ill.—The question of paving Ayer-st. is being urged by the business men.

Athens, Ga.—About 10,000 sq. yds. of macadam pavement is contemplated. J. W. Barrett, cy. engr.

Bay City, Mich.—The question of issuing $60,000 for stone roads will be voted on April 7.

Pasadena, Cal.—The construction of cement street gutters is proposed. Cy. Eng. Allin.

Racine, Wis.—The J. I. Case Threshing Machine Company has made a proposition to this city offering to pave Ontario-st., from Bridge to State-st., with brick.

Newburyport, Mass.—(Special.)—About two miles of macadam paving will be laid this year.

Wareham, Mass.—The sum of $3,000 has been appropriated for macadamizing South Boulevard.

West Duluth, Minn.—The business men are urging the matter of repaving Fifty-ninth-ave., west.

Iowa City, Ia.—The property-owners on Washington-st. have petitioned for brick paving.

Port Huron, Mich.—A petition will be circulated asking that Tenth-st. be paved this summer.

Syracuse, N. Y.—Paving is contemplated for W. Fayette-st., from W. Genesee-st. to the Gere block.

Birmingham, Ala.—Ordinances are pending providing for artificial stone sidewalks in certain streets.

Frankfort, N. Y.—A bill has been passed authorizing this town to borrow $9,000 to improve Main-st.

Philadelphia, Pa.—An ordinance is pending appropriating $500,000 for paving the streets with asphalt.

Bay Ridge, N. Y.—Petitions have been submitted asking that a number of streets be paved and improved.

Albion, Mich.—The property-owners on Superior-st. have petitioned for paving from Michigan-ave. to Ash-st.

Manchester, N. H.—The block paving on Elm-st. will be extended as far north as Lowell-st. and south to Central-st.

Baltimore, Md.—New bids will be asked for, under amended specifications, for asphalt block paving.

Los Angeles, Cal.—Sunset boulevard is to be improved. Broadway-st., from Second to Main, will be paved.

Topeka, Kas.—Vitrified brick paving is desired for Harrison and E. Fourth-sts. J. H. Squires, Cy Clk.

Boydton, Va.—The town council appropriated, March 10, about $450 for improving the streets and sidewalks.

Fayetteville, N. C.—The question of issuing $100,000 road improvement bonds will be voted on this spring.

Winchester, Mass.—This town voted $6,500 for macadam paving in Forest, Washington, Church and Windston-sts.

Waukesha, Wis.—Plans and specifications for macadamizing McCall-st. are being considered by the common council.

Massillon, O.—The question of issuing $40,000 bonds for paving will be voted on, according to press reports.

Worcester, Mass.—Asphalt paving is advised for the streets of this city by George W. Tillson of Brooklyn.

Champaign, Ill.—A petition is being circulated for paving First-st., from Green-st. to University-ave.

Denver, Col.—A plant is being formulated for macadamizing Colfax-ave. from the Denver line to Montclair.

Freedom, Pa.—An ordinance has been approved for the establishment of a grade on Third-ave. F. G. Duerr, burgess.

Grand Rapids, Mich.—Asphalt paving is contemplated for E. Bridge-st., from Canal-st. to the bridge over Grand river.

Glassport, Pa.—This town will vote April 12 on a bond issue for $75,000 to be used in paving, sewers and electric lighting.

Vernon, Conn.—Bids will be asked soon for the continuation of the state macadam road between Rockville and Talcottville.

Bessemer, Ala.—Bids are asked until April 15 for $70,000 sewer bonds and $15,000 school bonds. Thomas T. Huey, mayor.

Galt, Ontario, Canada—The construction of cement walks is contemplated for a number of streets. J. McCartney, town clk.

Redlands, Cal.—The question of $70,000 bonds, of which $50,000 is for street improvement, will be voted on April 12.

San Francisco, Cal.—The property-owners on Frederick-st. have petitioned for bituminous rock paving and stone curbing.

Biddeford, Me.—President Goldthwaite advocates the construction of macadam roads and the purchase of a portable stone crusher.

Kankakee, Ill.—The property-owners contemplate petitioning the council to pave an alley with brick or creosoted wood blocks.

St. Joseph, Mo.—Ordinances were introduced March 17 for paving an alley with brick and for building second-class sidewalks.

Montgomery, Ala.—Mayor Joseph has been requested to have some streets leading to Oak park improved so as to make a fine drive.

Lincoln, Neb.—Bids will be received until April 14 for district paving bonds for repaving Nos. 8 and 13. Beman C. Cox, cy. treas.

Sioux Falls, S. D.—A resolution was adopted March 18 to macadamize Sixth-st., from Main to Dakota-aves., and to grade certain streets.

Oneida, N. Y.—The board of public works is in correspondence with engineers to prepare plans for paving and sewer construction.

Watertown, N. Y.—The legislature has passed a bill authorizing city bonds for $75,000 for paving highways and sewers. Mayor Pappa.

Davenport, Ia.—A petition is being circulated for paving Fifteenth-st., from Harrison to Brady, and constructing permanent sidewalks.

Peoria, Ill.—Ordinances were passed March 11 for paving Adams-st., from

Western to Oregon, and University-st., from Bradley to Main.

Elgin, Ill.—A petition will be presented to the board of local improvements for paving the residence portion of Douglas-ave. with asphalt.

Neenah, Wis.—The property-owners on Main-st., from Wisconsin-ave. to the Wisconsin Central railroad tracks, have petitioned for macadam paving.

Ashland, Wis.—(Special.)—M. W. Fisher, city clerk, says that this city contemplates making extensive street improvements this year, probably using brick.

Aurora, Ill.—A petition is being circulated for paving Galena-st., from Oak-ave. to the Geneva branch track of the C., B. & Q. railroad, with asphalt.

Moline, Ill.—The extension of the Fifth-ave. brick paving from Twelfth-st. west to Eighth and south on Eighth to Eleventh-ave. has been petitioned for.

Des Moines, Ia.—A resolution of necessity for brick paving on E. Twelfth-st., from Grand-ave. to Washington-st., has been filed with the city clerk.

Riverside, Cal.—The property-owners on Tenth-st., from Walnut to Pechappa-ave., have petitioned for a gravel roadway, cement curb and gutter and cement walks.

Ashland, Wis.—A resolution has been adopted to build 8-ft. sidewalks on both sides of Thirteenth-ave., E., between Second and St. Clair-sts. Mayor Williams.

Elkhart, Ind.—A resolution was referred to the street committee March 12 for paving Franklin-st., from Maine to the river, with brick. Kit McKean, cy. clk.

Traverse City, Mich.—The council and board of assessors will meet April 7 to review the assessment rolls for the proposed paving of Union-st. Chas. M. Beers, cy. clk.

Duluth, Minn.—Experiments are to be made with sandstone and creosoted wood block paving at the intersections on the south side of Superior-st. Cy. Eng. Patton.

Atlanta, Ga.—Mayor Minis contemplates devising some plan for the improvement of the condition of the streets and sidewalks, especially in the central part of the city.

Riverside, Cal.—Granite, brick or asphalt sidewalks are contemplated for Seventh, Eighth and Ninth-sts., between the Southern Pacific and Santa Fe tracks.

Harrisburg, Pa.—A petition will be submitted to councils asking that Market-st. be paved east of the subway as far as Eleventh-st. Paving is also proposed for State-st.

Shenandoah, Ia.—Resolutions have been passed for paving Sheridan-ave., Sycamore, Blossom, Elm, Maple and E. Railroad-sts. with brick. C. M. Conway, mayor; J. Swain, cy. clk.

New Orleans, La.—The city engineer has been directed to prepare plans and specifications for paving Prytania-st., from Philip to Ohio, and Polymnia, from Coliseum to Carondelet.

Newark, N. J.—Asphalt resurfacing is proposed for James-st. and Washington-place. Petitions have been submitted for paving part of Clifton and Avon-aves. and Van Buren and Vesey-sts.

Alexandria, Va.—An ordinance was adopted March 12 providing for the appropriation of the cost of grading, paving and curbing Fairfax-st., from King-st. to Printer's alley. Mayor Simpson.

Neenah, Wis.—(Special.)—L. C. Hjorth, city engineer, says that this city will advertise soon for bids for 1,550 sq. yds. macadam paving on Forest-ave. with cement combined curb and gutter.

Evansville, Ind.—The board of public works has ordered artificial stone sidewalks in the upper part of the city. Petitions have been received asking that certain alleys be improved.

Marinette, Wis.—The council formally decided, March 13, to pave Main-st., from the railroad tracks near Mann-st. to Odd Fellow-st., with brick over macadam foundation, with stone curbing. Cy. Eng. Hillis.

Bessemer, Col.—The property-owners on Abriendo-ave., between Northern-ave. and Bay-st., will petition the council for cement sidewalks. The council has ordered sidewalks laid in Evans-ave. Cy. Engr. Peach.

Camden, N. J.—Repaving is contemplated as follows: Asphalt, Fifh-st., from Federal to State; Belgian block on concrete base, Front-st., from Federal to State, and Second-st., from Bridge to Kaighn-aves.

Marinette, Wis.—The property-owners on Mann-st., from Main to Ludington, have petitioned for macadam paving. The board of public works will report in favor of brick for the extension of Main-st. to Stanton-st.

Chicago, Ill.—The north half of Sixteenth-st. in the Midway Plaisance, from Cottage Grove-ave. to Woodlawn-ave., will be paved, and Fayette-ave., and the east drive in Washington park will be resurfaced.

Seattle, Wash.—Plans and specifications are being prepared for paving Madison, Marion and Columbia-sts. with fir blocks. Concrete walks will be constructed on Highland-drive and Summit-ave. Cy. Eng. Thomas.

Connersville, Ind.—(Special.)—Karl L. Hanson, cy. engr., says that ordinance for building cement sidewalks was killed at the last meeting of the city council, and there will be no letting of contracts April 17, as advertised.

Minneapolis, Minn.—University-ave., southeast, from Seventh to Tenth-aves., and Hennepin-ave., from Tenth to Thirteenth-sts., will be paved with brick, and Twentieth-ave., north from the river to Washington-ave., will be paved with sandstone.

Owensboro, Ky.—An ordinance has passed first reading providing for the construction of cement pavements on Frederica-st. An ordinance was passed for constructing concrete pavements on certain streets. Mayor Yewell, Cy. Clk. O'Bryan.

Spokane, Wash.—An ordinance has been introduced which provides that hereafter all sidewalks shall be constructed of cinders, asphalt, vitrified brick or cement. Only asphalt, brick or cement walks shall be permitted inside the fire limits.

Chicago, Ill.—Asphalt paving has been ordered continued on Arlington-place, from N. Clark to Orchard-st. The unimproved troroughfares through the Drexel estate tract in Englewood will be paved with macadam his year by private contract.

Marshalltown, Ia.—The city council adopted specifications March 3 for paving and curbing to be laid during 1902. The paving will be two-course brick on ground foundation, with sand filler, and the curbing Kettle river sandstone, with a back filling of gravel.

Detroit, Mich.—The committee on streets has recommended resurfacing for Twenty-first-st., from Lafayette to Baker, and Eleventh-st., from Leverette to Michigan. Repaving: Wabash, Tenth and Vinewood with cedar; Fourth, Junction, Hoffman and Stanton-sts. with brick.

York, Pa.—Bills passed first reading March 10 for grading and macadamizing portions of Jackson, Vine, Walnut, Park, Garfield, York, Princess and King-sts., Plank road, Linden and College-aves., and for asphalt paving on Center-square and adjacent sections on Market and George-sts.

Marion, Ia.—A resolution has been approved amending the specifications for asphalt paving on Seventh-ave., Tenth, Eleventh and Twelfth-sts., so as to admit any asphalt as good or better than Trinidad Pitch Lake, Bermudez, California Alcatraz or any standard and first-class brand. P. M. Plumb, mayor.

Springfield, Mass.—(Special.)—Plainfield-st. will be widened at a cost of about $35,000, of which one-half will be borne by the Springfield Street Railway Company. The street will be widened by buying a strip of land some 16½ ft. wide along the northerly side. The kind of paving to be used has not been decided upon. It is macadamized now.

St. Louis, Mo.—Bills were passed March 14 for reconstructing street as follows: King's highway boulevard, from Lindell boulevard to Eastern-ave., asphalt; Westminster-place, from Spring-ave. to Walton-ave., creosoted wood blocks. Bills were passed for brick paving on Spring, Compton, Taylor, Boyle and Lawton-aves. and Whittier, Walnut and Fourteenth-sts.

Indianapolis, Ind.—Papers have been ordered prepared for asphalt paving on Noble, Twentieth, Tenth, West, Blake and Pine-sts., Cornell, Park and Madison-aves; brick, Osage, Ellsworth, Missouri and California-sts.; creosoted wood blocks, Michigan, North and Vermont-sts. Petitions have been filed for brick paving on Norwood and Walnut-sts. and cement walks on Washington, Montana and North-sts.

Holyoke, Mass.—(Special.)—The financial budget just passed makes an appropriation for permanent street work, but it is planned to float a loan of perhaps $25,000 for street work of this kind. If this is done it will be divided between macadam and vitrified brick. The city will continue the policy of laying vitrified brick to replace the Belgian block, removing the latter to the hill streets, where the vitrified brick is less adapted for giving a foothold for heavy laden teams.

Springfield, Mass.—(Special.)—The board of supervisors of highways and bridges have asked for an appropriation of $46,000 for permanent street work. The budget has not been decided, however. It is probable the greater part of this amount will be spent for vitrified brick, one of the supervisors intimating that $20,000 would be needed.

CONTRACTS TO BE LET.

Cohoes, N. Y.—Bids will be received April 2 for paving Chestnut, Oak and Walnut-sts. and McElwaine-ave.

Napoleon, O.—Bids are asked until April 3 for constructing various county roads. C. E. Coe, co. audt.

Marion, Ala.—Sealed bids are asked until April 7 for grading 1¼ miles of Maine-st. H. W. Enghurst, chm. st. com.

Mansfield, O.—Sealed bids are asked until April 12 for constructing sidewalks on W. First and Wayne-sts. F. M. Remy, cy. clk.

Ft. Wayne, Ind.—Sealed bids are asked until 7:30 p. m., April 3, for improving Buchanan and Force-sts. A. M. Schmidt, clk.

Cincinnati, O.—Sealed bids are asked until April 14 for grading, curbing and macadamizing Wold-ave. Geo. F. Holmer, clk. B. P. S.

Conneaut, O.—(Special.)—Sealed bids are asked until 12 m. April 26 for 13,800 sq. yds. of brick paving on Broad-st. Geo B. Pike, cy. eng.

Mankato, Minn.—Sealed bids are asked until 2 p. m., April 2, for paving Broad-st., from Lincoln to Vine, with asphalt. J. E. Porter, pres. B. P. W.

Moline, Ill.—Bids have been authorized for paving Seventh-ave., between Nineteenth and Twenty-seventh-sts., with asphalt. Chas. G. Carlson, cy. eng.

Oshkosh, Wis.—Sealed bids are asked until 12 m., April 7, for grading and graveling Jefferson-ave., from Lincoln-ave. to Sterling-st. Frank Monahan, chm. B. P. W.

New Bedford, Mass.—Bids are asked until April 5 for building 2,000 ft. of macadam road in Fort Rodman. Thos. H. Slavens, Q. M., Newport, R. I.

Jeffersonville, Ind.—Sealed bids are asked until April 7 for construction of macadam and gravel roads in Silver Creek, Union and Monroe townships. Geo. W. Badger, co. audt.

Sheboygan, Wis.—Sealed bids are asked until 3 p. m., April 7, for 11,434 sq. yds. of macadam paving, 190 sq. yds. brick crosswalks, 5,488 lin. ft. combined curb and gutter. C. U. Boley, chm. B. P. W.

St. Louis, Mo.—Sealed bids are asked until 12 m. April 17 for constructing vitrified brick roads, curbing and drainage of grounds of the U. S. Clothing Depot. Lieut.-Col. C. R. Barnett, Depot Q. M.

Silver City, Idaho—Sealed bids are asked until April 14 for improving and keeping in repair a number of public roads and highways. Chas. Farney, chm. bd. co. com.; E. L. Ballard, co. clk.

Corydon, Ind.—Sealed bids are asked

until 1 p. m. April 10 for constructing free gravel roads in Blue River and Harrison townships. Andrew J. McIntosh, chm. co. coms.; Jas. A. Watson, co. audt.

Wyoming, O.—Sealed bids are asked until 2 p. m. April 5 for macadamizing Worthington-ave. with 2,250 ft. of cement concrete combined curb and gutter. Contracts will be let separately. L. W. Mathewson, vil. eng.

Toledo, O.—Sealed bids are asked until 12 m. April 14 for paving Michigan-st., from Monroe to Madison, with asphalt or asphalt blocks, and Front-st., from Dearborn-ave. to Millard-ave., with vitrified blocks or asphalt blocks. J. E. Connell, cy. clk.

Bay City, Mich.—Sealed bids are asked until 2:30 p. m. April 8 for paving Center-st. with asphalt or Warren's bituminous macadam pavement. Bids will be received April 8 for paving the right-of-way of the Bay Cities Consolidated Railroad Company, with vitrified brick. Mathew Lamont, chm. B. P. W.

DeKalb, Ill.—(Special.)—Sealed bids are asked until 10:15 a. m. April 9 for grading, curbing and paving N. First-st., S. First-st., S. Fourth, E. Main and John-sts., including the following: Brick paving, 43,155 sq. yds.; macadam paving, 2,256 sq. yds.; stone curbing, 23,966 lin. ft.; concrete combined curb and gutter, 1,496 ft.; excavation, 8,823 cu. yds.; 66 inlets. Walter M. Hay, cy. eng.

Bellefontaine, O.—Sealed bids are asked until 12 m. April 2 for brick paving, stone curbing, storm sewers, cast iron inlets in N. Detroit and S. Detroit-sts. and Sandusky-ave. Bids will also be received April 2 for 3,050 ft. of stone or cement curb, 2,850 ft. of cement or stone gutter, 1,000 sq. ft. of stone or cement sidewalks and cross-walks, and 1,500 cu. yds. of gravel roadway. M. J. Nichols, cy. clk.

Dayton, O.—Sealed bids are asked until 12 m. April 16 for paving with brick or asphalt the following streets: Third-st., from Findlay to Irwin, paving, 8,036 sq. yds.; straight curbing, 3,150 lin. ft.; circular curbing, 190 lin. ft.; headers, 370 lin. ft. Springfield-st., from Third-st. to Hydraulic race, paving, 4,040 sq. yds.; straight curb, 2,120 lin. ft.; circular curb, 32 lin. ft.; headers, 50 lin. ft. G. F. Kuhns, prest. bd. cy. affairs.

CONTRACTS AWARDED.

Joliet, Ill.—The contract for curbing Fifth-ave. was awarded to Frank Murphy for $1,105.96.

Erie, Pa.—The contract for paving around Central park was awarded, March 24, to Mayer Bros. at $1.79 a sq. yd. for asphalt.

Duluth, Minn.—The contract for paving Nineteenth-ave. E., with tar macadam was awarded, March 17, to P. McDonnell for $24,174.85.

Greenwich, Conn.—The contract for building a section of highway at Mianus bridge was awarded to M. A. Zuccardy of New London, Conn., for $5,255.50.

Baltimore, Md.—The contract for paving Hanover-st. with Belgian block was awarded to the Filbert Paving Construction Company for $20,246.

Laporte, Ind.—The contract for constructing several miles of macadam pavement was awarded to G. S. Van Deusen & Co. of Michigan City for $100,000.

Toledo, O.—The contract for paving Bancroft-st., from Ashland to Lawrence, with asphalt block was awarded, March 6, to C. H. Burchenal for $32,737.50.

Crawfordsville, Ind.—The contract for paving 21,000 sq. yds. of Washington-st. was awarded to W. W. Hatch & Son of Goshen at $1.34 a sq. yd. for brick.

Anderson, Ind.—The contract for constructing the J. C. Thorn gravel road was awarded to Calvin Miller of Decatur, Ind., for $9,444.

Nashville, Tenn.—The contract for laying the granitoid pavement along the esplanade surrounding the state building was awarded, March 12, to the Nashville Roofing and Paving Company for $3,996.50.

Wabash, Ind.—The contract for 14,000 sq. yds. of asphalt paving on Main and Wabash-sts. was awarded, March 10, to the Interstate Construction Company at $1.69 a sq. yd. for Kentucky rock asphalt, with a ten years' guarantee.

Bloomington, Ill.—Contracts for brick paving were awarded, March 12, as follows: W. Chestnut-st., 12,158 sq. yds. on macadam $1 and 1897.4 sq. yds. on concrete $3.43, John Cherry, jr.; Madison-st., 1,907 sq. yds. $1.45, and Wood-st., 3,004 sq. yds., $1.32 a sq. yd., E. G. Dickerson of Danville.

Birmingham, Ala.—Contracts were awarded, March 4, as follows: Graveling, macadamizing and curbing in Jonesville, Dunn & Lallande Bros., $40,741.96; curbing and paving certain sidewalks in Jonesville, Granolythic Stone Company, $5,932; grading and macadamizing Twelfth-st., C. M. Burkhalter & Co., $12,161.

Minneapolis, Minn.—The lowest bids received March 14 for furnishing paving materials were as follows: Brick, J. C. Landers of Minneapolis, 84½ cts. a sq. yd; asphalt, Barber Asphalt Paving Company, $1.60 a sq. yd. laid and $1.52 a sq. yd. deposited on the street; cedar blocks, Conway Cedar Company, Chicago, 55 cts. a sq. yd.; sandstone, Kettle River Quarry Company, $1.45 a sq. yd.; cement natural, J. C. Landers, 78 cts. a barrel; cement Portland, Guarantee Cement Company, Minneapolis, $1.60 per barrel; clay pipe for sewers, Red Wing Sewer Pipe Company, 12-inch pipe, 38 cts. a ft.; 18-inch pipe, 53 cts. a foot.

SEWERS.

Washington, D. C.—The sewage disposal system now under course of construction will be completed within the next three years.

Helena, Ark.—The sewerage system recently completed by Guild & Co., of Chattanooga, Tenn., has developed, under inspection, several weak points, acording to press reports, and it is probable that the system will not be accepted by the city.

New Orleans, La.—Messrs. George H. Benzenberg of Milwaukee, Charles Hermany of Louisville, Ky., and Rudolph Hering of New York City, have been named by President Walmsley of the

board of drainage commissioners of this city to conduct the investigation of the character of the work and material employed in the new drainage system and the character thereof.

CONTEMPLATED WORK.

Albion, Mich.—A sewer is contemplated in Erie-st.

Washington, Ia.—A sewage disposal plant is contemplated.

Janesville, Wis.—Plans for a sewerage system have been adopted.

Methuen, Mass.—The sum of $3,500 will be appropriated for sewers.

Sanford, Me.—The question of building sewers is being considered.

Monmouth, Ill.—The sewer ordinance is about completed by Cy. Eng. McClanahan.

Angola, Ind.—The question of building a sewerage system is being considered.

Watertown, Mass.—This town voted to appropriate $5,000 for sewer extensions.

Chattanooga, Tenn.—Sewers on Harrison-ave. and Douglas-st. are contemplated.

Seneca Falls, N. Y.—The question of building a sewerage system is being agitated.

Rockford, Ill.—Petitions are being circulated for building a sewer down Kent creek.

Ensley, Ala.—Mayor Scott is considering a plan for installing a sewerage system.

Belvidere, Ill.—An ordinance was passed March 17 to build a sewer on W. Hurlburt-ave.

Omaha, Neb.—An ordinance was passed March 18 to construct a sewer alongside Saddle creek.

Bay City, Mich.—Sewers will be constructed in two alleys. Mr. Cunningham, mayor.

North Andover, Mass.—Sewers will be built in Cleveland, Glenville and Second-sts.

Natick, Mass.—This town voted $7,000 for the extension of the sewerage system.

Hummelstown, Pa.—A petition is being circulated asking that the west end be sewered.

Waukesha, Wis.—Plans and specifications have been adopted for a sewer in Barstow-ave.

Houghton, Mich.—Surveys are being made preparatory to making plans for a sewerage system.

New Haven, Conn.—An ordinance has been passed for building a sewer in Blatchley-ave.

Cincinnati, O.—An ordinance was passed March 17 to construct sewer and drain in Glenwood-ave.

Northfield, N. H.—This town has voted to build a sewerage system according to press reports.

Mansfield, O.—Ordinances have been passed for building sewers in Lexington-ave. and E. Second-st.

Patchogue, L. I., N. Y.—This town voted to issue $10,000 bonds for building a sewer in Rider-ave.

Des Moines, Ia.—The city engineer will prepare profiles for a sewer to be built in Highland park.

Los Angeles, Cal.—A conduit to carry the sewer, water, electric light and gas mains, is contemplated.

Brookland, D. C.—Estimates have been prepared for building a sewer for this place at a cost of $342,000.

Melrose, Mass.—Mayor Larrabee has recommended an expenditure of $25,000 for surface drainage this year.

Springfield, O.—Plans and specifications have been prepared for a sewer in W. Main-st. Cy. Engr. Sieverling.

Rockville, Conn.—An appropriation of $15,000 for building a storm sewer in Union and Maple-sts. is proposed.

Freeport, Ill.—An ordinance has been adopted for a storm sewer along the business portion of Stephenson-st.

East Las Vegas, N. M.—(Special.)—Plans for a sewerage system will be prepared by Andrew Rosewater of Omaha, Neb.

Ridgewood, N. J.—(Special.)—The village board of trustees contemplate the construction of a sewerage system. F. M. Richardson.

Paris, Ill.—The contract for building 2,000 ft. of sewers will be let the latter part of May. W. C. Lemen, cy. eng.

Fernandina, Fla.—The question of issuing $75,000 bonds for building a sewerage system was favorably voted on March 17.

Glassport, Pa.—The question of issuing $75,000 bonds for sewers, paving and electric lights will be voted on April 12.

Skowhegan, Me.—The sum of $2,000 has been appropriated for a sewer in Madison-ave. and $800 for a sewer in North-ave.

Philadelphia, Pa.—Bills have been passed authorizing the construction of main sewers at a cost of $200,000 in a number of streets.

Gallitzin, Pa.—(Special.) — Plans and specifications for main brick sewers are about completed and bids will be asked soon. J. Luder, eng.

Sarnia, Ont.—Petitions have been received by the council asking for sewers on Christina and Confederation aves., Savoy-st. and College-ave.

Pella, Ia.—A 12 in. vitrified tile sewer, leading from Main and Union-sts. to the city limits is contemplated at a cost of $2,000.

Martinsburg, Pa.—Councilmen Wester, Laver, Kline and Cullen compose the committee to consider the proposed sewerage system.

Columbus, Ga.—(Special)—The question of issuing $150,000 bonds to build a new system of sewers will be voted on June 19. Robt. S. Johnson, Supt. pub. works.

Oneida, N. Y.—The board of public works is corresponding with engineers regarding the preparations of plans for sewer construction and paving. Mayor Pfaff.

Terre Haute, Ind.—The finance committee reported in favor of recommending an appropriation of $10,790 for building sewers in the northeast part of the city.

Danbury, Conn.—Appropriations are being considered for 3,100 ft. of sewers in several streets, improvements at the city filtration beds and the disposal of surface water.

Columbus, O.—The plans of Cy. Eng. Griggs for the proposed sewers have been adopted and the question of issuing $400,000 bonds for the construction will probably be voted on in April.

Scranton, Pa.—The superintendent of the bureau of engineering has been directed to prepare plans for the construction of a sewer to drain a part of Providence road and the surrounding land.

Pasadena, Cal.—A resolution was approved, March 18, for building sewers in Lincoln, Orange Grove, Yoho, Manzanita and Carlton-aves. and Peoria-st., including 12 manholes and 4 flush tanks. Herman Dyer, cy. clk.; M. H. Weight, mapor. Mayor.

Dunkirk, N. Y.—The council has ordered plans and specifications prepared for a 12 in. sewer in Bass-st., 2,100 ft. long, with two lateral 10-in. sewers, each 800 ft. long, connecting on Fourth-st. Plans and specifications are also being made for a trunk sewer in Robert road 1 mi. in length. J. P. Groesch, cy. clk.

Ballston Spa . N. Y.—The report of Harvey M. Geer, C. E., on the cost of disposing of the sewerage of this city shows the following estimates: Covering Gordon creek sewers, $500; completing sewer system, $14,000; storm water sewers, $1,800; contact beds, pumping station and disposal structures, $45,000; engineering, experimental and contingent expenses, $8,000. Total, $67,800.

Pittsfield, Mass.—(Special.)—This city is establishing a sewage disposal plant which consists of reception tanks about a mile from the city, and about two miles further on filtration beds have been established, and it is proposed to force the sewage from the tanks to the beds and there it will be purified and disposed of. This work will be finished during the present summer.

Everett, Mass.—(Special.)—The most important engineering work for the year is the construction of the Woodlawn district sewer system. The district drained is 160 acres, about one-half of which is thickly populated. The intention of the engineering department is to have this system ultimately connected with the Metropolitan sewer system. Application has already been made for such connection. The work is being done by day labor. Another important work is the construction of a surface drainage system. The plans now being prepared by the city engineer represent an area to be drained of about five miles. Much of the work was started last year; but the larger part is yet to be done.

Salem, Mass.—(Special.)—This city has planned to establish a trunk sewer at an estimated cost of $535,868.16. A sewerage commission has decided in favor of discharging crude sewage into the sea, which is the system now in use by the North Metropolitan district of Boston. The sewage will be brought to the city's land situated near Salem's popular summer resort by two intercepting sewers, which will thoroughly drain the entire city. The city will in all probability build a pumping station at a cost of about $60,000 upon this land, and outfall pipe will discharge the sewage at the Great Haste Island, about two miles from shore. A strong current runs past this island which will carry the sewage to sea. This outfall sewer will be a thirty-inch, flexible joint, iron pipe, which is less expensive than building a brick sewer under water. This kind of pipe has been used in many instances and notably in the Boston system cited above. The estimated cost of operating and maintaining the system is $13,100 yearly.

CONTRACTS TO BE LET.

Cannonsburg, Pa.—Bids are asked until April 7 for building 7 miles of sewers. W. J. Gower, boro. clk.

Adams, Minn.—Sealed bids are asked until 5 p. m. May 1 for building sewers. Wm. W. Dean, vil. recorder.

Decatur, Ind.—Sealed bids are asked until April 22 for cast iron pipes and stone headers for sewer pipes. A. Bock, audt.

Valparaiso, Ind.—Sealed bids will be received April 11 for building a brick sewer from Water to Morgan-st. Mayor Woodhill; cy. clk.

Plattsburg, N. Y.—Bids are asked until April 12 for building about 3 miles of vitrified pipe sewer. C. E. Johnson, secy. improvement com.

Camden, N. J.—Bids are asked until April 7 for the erection of a sewage disposal plant at the county hospital at Asyla. Samuel Wood, chmn. asylum com.

South Bend, Ind.—Sealed bids are asked until April 8 for 5,600 ft. of trunk sewer and 2,000 ft. of lateral sewer. A. J. Hammond, cy. engr.

Washington, D. C.—Sealed bids are asked until 12 m. April 5 for the construction of cofferdam, facade walls, outlet section of sewer and tide-gate chambers and storm water conduits at the sewage pumping station. H. B. F. McFarland, chmn. dist. comrs.

CONTRACTS AWARDED.

Joliet, Ill.—The contract for sewer work was awarded to Patrick McHughes for $2,197.

Petoskey, ch.—The contract for a sewer in Grove-st. was awarded to Jas. S. King for $1,092.80.

Youngstown, O.—A. O'Hara was awarded the contract for a sewer in Hilman-st. for $11,414.

Maryville, N. D.—The contract for a sewerage system was awarded to James Kennedy of Fargo for $13,603.

Lawton, Ok. T.—The contract for building a sewerage and water works system was awarded to J. L. Carter for $100,000.

Kokomo, Ind.—The contract for 1,100 ft. of 15-in. and 1,800 ft. of 12-in. sewer was awarded to Patrick Donnelly.

West Homestead, Pa.—The contract for building a sewerage system was awarded to Ott Bros. of Pittsburg for $26,700.

Meadville, Pa.—The contract for a sewer in Willow-st., between Liberty and S. Main, was awarded to Frederick Robinson & Co.

Salt Lake City, Utah.—(Special.)—The contract for constructing pipe sewers

was awarded Feb. 28 to the Colorado Company of Denver.

Seattle, Wash.—Bell & Pine secured the contract for a sewer on First-ave. west from Highland-drive to Gales-st., for $1,342.50.

Marshall, Mo.—The contract for building a sewer in sub-district No. 3 of sewer district No. 2 was awarded to W. H. Kolkmeyer & Co.

Milwaukee, Wis.—The contract for constructing sections Nos. 3 and 5 of the west side intercepting sewer was awarded to F. J. Scanlon at $4.59 a lin. ft.

Evansville, Ind.—The contract for building a sewer in block 18, Heidelbach & Elsa's enlargement, was awarded to John L. Neuman at 24 cents a ft. for the main sewer and 90 cents for the Y's.

Erie, Pa.—The contract for building a 9-in. sewer in Vine-st. was awarded to Dennis O'Brien, as follows: For 9-in. pipe, 50 cents; 6-in. pipe, 35 cents; 8-in. Y or T branch, 80 cents; manholes, $35.

WATER-WORKS.

CONTEMPLATED WORK.

Dunkirk, N. Y.—The question of water meters is being considered.

Oneida, S. D.—Water mains will be laid in a number of streets this year.

Red Wing, Minn.—The question of using water meters is being considered.

Mitchell, S. D.—The question of water meters is being discussed.

Elkhart, Ind.—This city voted, March 18, to build municipal water works.

Norfolk, Va.—The construction of a new 33-inch water main will be voted on.

Grand Island, Neb.—The question of extending the water mains will be voted on.

Lynchburg, Va.—The construction of a gravity water works system is contemplated.

Wilmerding, Pa.—The residents here have petitioned for a better water system.

Oneida, N. Y.—The extension of the water mains through Spring and Maple sts. and Pleasant-ave. will be made.

Tewksbury, Mass.—This city voted an appropriation for surveys and driven wells for water works.

Lima, O.—The question of issuing $150,000 bonds for additional water works storage reservoirs will be voted on.

Ogden, Utah.—The special committee appointed by council has recommended that the city build new water works.

Tamaqua, Pa.—The question of issuing $35,000 bonds for improving the water works will be voted on April 15.

Evansville, Wis.—This city voted, March 5, to bond itself for the purchase of the water works and electric light plants.

West Point, Neb.—The question of issuing $7,500 bonds for the extension of the water works system will be voted on.

Owen, O.—A water works system, electric light plant and power plant will be constructed for this town by John D. Owen.

Simsbury, Conn.—A report on a proposed better water supply will be made by Theo. H. McKenzie of Southington, Conn.

Washington, D. C.—The residents of Congress Heights have requested the District commissioners to extend the water main to that place.

Minneapolis, Minn.—The legislature has authorized this city to issue bonds for $250,000 for the extension of the water works system.

Kewanee, Ill.—An ordinance has been approved to issue $10,000 bonds for constructing a reservoir. Frank F. Whiffen, mayor.

Belvidere, Ill.—The city council has decided upon 6,000 ft. of water mains extension, a reservoir of 500,000 gals. and a new triplex pump.

DeQueen, Ark.—W. A. Rees of the firm of Rees & Rees, Fayetteville, Ark., has been employed to prepare plans and specifications for a water works system.

Marshalltown, Ia.—The city council adopted, March 17, the recommendation of the water committee for the addition of 20 wells to the present water works system, at a cost of $10,000.

Newly incorporated water companies: Aurora Water Company, Aurora, Ind.; Hobart Water Works and Sewer Company, Hobart, Ok. T.; Stamford Water Works and Electric Light company, Jersey City, N. J.

The question of issuing water works bonds has been favorably voted on at the following places: Mt. Pleasant, Tex.; Oakland, Md.; Walnut, Ill.; Cold Spring, Minn.; Lancaster, Tex.; Warren, Minn.; Truman, Minn.; East Jaffrey, N. H.; Natick, Mass.; Weymouth, Mass.; Troy, Pa.

The question of issuing water works bonds will be voted on at the following places: Virginia, Ill., April 8; Wellsville, O., April; Sioux Falls, S. D.; Mineral Wells, Tex., April 3; Seymour, Wis., April 1; De Smet, S. D., April; Prairie Du Chieu, Wis., April; White Lake, S. D.; New Lincoln, Wis.; Seymour, Wis.; New Richland, Minn.; Elmore, O.

Baker City, Or.—(Special.)—The city will advertise April 1 for bids for the construction of about 51,500 ft. of new water mains of 4, 6, 8 and 10-inch, also about 50 hydrants and 99 gates of all sizes up to 10-inch. Bids will be received for furnishing material separate from the labor, as well as for the entire contract. The work must be completed by Dec. 15, 1902. O. C. Stern, supt.

The construction of water works systems is contemplated at the following places: Colfax, Ill.; Dexter, Me.; Steamboat, Col.; Woodhull, Ill.; Bloomer, Wis.; Lamont, Ia.; Bedford, Ia.; Fox Lake, Wis.; Grass Lake, Mich.; Clay Center, Neb.; Crab Orchard, Neb.; Mountain View, Ok. T.; Albia, Ia.; Hamilton, Mass.; Coventry, R. I.; Norwood, N. Y.; Port Dickinson, N. Y.; Salem, N. J.; Kennedy Heights, O.; Mena, Ark.; Conroe, Tex.; Jamestown, N. D.

Gloucester, Mass.—(Special.)—For additional source of water suppply, which is already undertaken, the territory or basin, known as Haskell's pond, containing about 89 acres, has been taken. Various estimates are made on the actual cost of

this work, before it is completed, but conservative opinions set it at about $300,000. Then there is the extension of the water mains to Annisquam, one of the finest summer resorts on the North Shore. Bass Rocks, another domicile for summer sojourners, and along Eastern-ave. and Washington-st. for which the water commissioners ask $60,000.

Peabody, Mass.—(Special.)—This town will undoubtedly enter upon two public works of much importance the present year, and definite action will be taken upon them at a special town meeting to be called as soon as the committees which have them under consideration are ready to report, which will be within six weeks. These works are a new water works pumping station, with new pumps and boilers, to be erected on a new site, at an estimated cost of from $60,000 to $70,000, and a new brick high school building, which will cost about $100,000. The chairman of the committee is Harry F. Walker.

Lynn, Mass.—(Special.)—The municipal water supply system will be increased this year through the enlargement of the dam at Walden pond, one of the basins from which the city secures its water, and by the construction of a pumping station. The cost of the undertaking will be about $400,000 and the city council has provided for the raising of the money by issuing 30-year 4 per cent. bonds. The dam will be built by contract, but the greater part of the work necessary in removing trees, leveling the banks and building roads will be done by Lynn citizens at $2 per day of eight hours.

CONTRACTS TO BE LET.

Batesville, Ind.—Sealed bids are asked until April 3 for building water works. Sturtevant & Todd, engrs., Chicago.

Matawan, N. J.—Bids are asked until April 2 for building a water works system. Geo. B. Shepherd, sec'y Water Company.

Tulare, Cal.—Bids are asked until April 8 for the purchase of a franchise for water mains, etc. John Cutter, jr., clk.

Sloan, Ia.—Sealed bids are asked until 7 p. m., April 21, for building a water works system. Dr. M. B. Hilts, mayor.

Sault Ste. Marie, Mich.—Bids are asked until 3 p. m., April 8, for constructing a new pumping station at Big Point. B. P. W.

Bridgewater, N. S., Canada.—Bids are asked until April 15 for constructing a water works and sewerage system. J. A. Curll, town clk.

Milwaukee, Wis.—Sealed bids are asked until April 8 for furnishing 1,800 tons of cast iron water pipe and 100 single nozzle fire hydrants. Chas. J. Poetsch, chmn. B. P. W.

Lafayette, Ind.—Sealed bids are asked until April 7 for laying about 5,000 ft. of cast iron water pipe, setting valves, hydrants, etc. Frank B. Southworth, chmn. trustees; Ed. Cunningham, supt.

Cincinnati, O.—Sealed bids are asked until April 4 for grading the grounds and the revetment of slopes for the construction of the pump pit and archway, the foundations of buildings and sewer pipe drains, laying the supply conduit, cast iron drains and valves for the Western pumping station. August Herrmann, pres. bd. trustees, W. W. commrs.

Wellville, O.—Sealed bids are asked until April 7 for the reconstruction of the water works distribution. The approximate quantities of pipe are as follows: 6 in. pipe, 5 pieces, weight 360 pounds per length, 12 feet, 4 inches; 8 in. pipe, 250 pieces, weight 600 pounds per length, 12 feet, 4 inches; 10 in. pipe, 6 pieces, weight 780 pounds per length, 12 feet, 4 inches, being a total of 78¼ tons of 2,000 pounds. William Perkins, supt. bd. W. W. trustees.

CONTRACTS AWARDED.

Woodhull, Ill.—The contract for a tower and tank for the proposed water works system was awarded to the Flint & Walling Manufacturing Company of Kendallville, Ind., for $3,603.

Wyoming, Ill.—The contract for a water works system was awarded to S. V. Deem of Galva, Ill., for $28,000.

Lexington, Ok. T.—The contract for a water works system was awarded to J. M. Carter of Abilene, Tex.

Harmony, Minn.—J. L. White of Peru, Ill., was awarded the contract for a water works system for $8,250.

Elgin, Tex.—The contract for a water works system was awarded to Carl F. Drake of Austin and J. W. Maxcy of Houston.

Keswick, Cal.—The contract for installing a water works system has been awarded to Schow, Ingram & Batcher for $20,000.

Van Buren, Me.—The contract for building water works was awarded to the Ticonic Construction Company of Waterville, Me.

Jeffersonville, N. Y.—The contract for building gravity water works was awarded to William T. O'Conner of Syracuse for $6,425.

BRIDGES.

Danby, Mich.—The question of building two iron bridges will be voted on.

Glasgow, Pa.—The stone arch bridge which was destroyoed by the flood, will be replaced with one of the same design.

Chatham, Va.—An appropriation of $6,000 has been made for a steel bridge across the Stanton river at Ward's old site.

Crookston, Minn.—The city council has decided to build a steel bridge across the Red Lake river from Main-st. to College-ave.

Nevada City, Nev.—Plans and estimates for a steel bridge across Deer creek will be received until April 9. Sidney Beard, town clerk.

Albion, Mich.—Sealed bids are asked until 2 p. m. April 8 for constructing several steel bridges on stone abutments. Thos. A. Huston, co. audt.

Columbia City, Ind.—Sealed bids are asked until 2 p. m. April 8 for the construction of three steel bridges. Stephen A. Martin, chmn. co. commrs.

Decatur, Ind.—Sealed bids are asked un-

til April 8 for the construction of twelve steel bridges, ten stone abutments, five stone arches, etc. Samuel Doak, chm. co. comm'rs.

Columbus, O.—Sealed bids are asked until 12 m. April 4 for the substructures and superstructures of nine bridges and paving the approaches to two bridges. L. C. Jones, co. audt.

Hartford, Conn.—The city government has formally approved the plans for the west approach to the new bridge, as prepared by the Connecticut river bridge and highway district commission.

Crawfordsville, Ind.—Sealed bids are asked until 10 a. m. April 8 for constructing three steel bridges on concrete abutments, seven concrete arch culverts, etc. William M. White, co. audt.; James A. Harding, co. surv.

Atlanta, Ga.—Sealed bids are asked until 3 p. m. April 7 for erecting a steel viaduct over the tracks of the Southern, Atlanta & West Point and Central railways at the Peters-st. crossing. R. M. Clayton, city engineer.

South Bend, Ind.—F. W. Keller, county surveyor, has been directed to prepare plans and specifications for a plate girder bridge with buckle plate floor and concrete filling, to replace the old bridge over the east race on E. Colfax-ave.

Columbus, Ga.—(Special)—Sealed bids are asked until 12 m. April 22 for building the superstructure of a steel highway bridge across the Chattahoochee river at Fourteenth-st. L. H. Chappell, mayor; W. C. Lawrence, chairman bridge commissioners.

New Philadelphia, O.—Sealed bids are asked until 12 m. April 18 for the construction of a stone arch bridge, superstructure and substructure, across Little Stillwater creek at the west end of Center-st., Dennison,O. C. C.Fernsell, co. audit.

Ogden, Utah.—Sealed bids are asked until 2 p. m. April 7 for erecting a steel highway bridge across Weber river from West Weber to Plain City and for the purchase of materials of an old steel bridge at the mouth of Ogden canyon. C. R. Hollingsworth. co. clk.

Newburyport, Mass.—(Special)—A new five truss drawbridge across the Merrimac will be built this year. It will be an iron structure with tubular piers, about 1,000 feet by 40 feet wide. The driveway will be paved with vitrified brick. The contract has not yet been awarded. The plans were made by Engineer Andrews of the Boston Bridge company.

STREET LIGHTING.

Pitcairn, Pa.—Bids will be received in April for an electric light plant.

Canajoharie, N. Y.—This village voted to make a contract for lighting by electricity.

Anderson, Ind.—A franchise was granted March 19 to the Home Heating Company for a period of thirty years.

Fulton, N. Y.—The Fulton Light, Heat and Power Company has been incorporated to furnish light, heat and power to this city, Phoenix, Syracuse and a number of other towns.

Maxwell, Ia.—The franchise for lighting and heating was granted to the Iowa Light & Heat Company.

Bentonville, Ark.—Plans for an electric light plant are being made by Rees & Rees of Fayetteville.

Tonawanda, N. Y.—A franchise for an electric lighting system was granted to the Niagara Light, Heat & Power Company.

Burlington, Ia.—A franchise for electric light, power and gas has been granted the General Electric Company of Chicago.

Will vote on issue of bonds: Jackson, Mich.; Anita, La.; Hubbard, O.; April 7, Prospect, N. Y.; Cold Spring, Minn.

Grafton, W. Va.—The contract for an electric plant was awarded to the Iron City Engineering company of Pittsburg for $5,000.

New Orleans, La.—Sealed bids are asked until April 7 for constructing an electric lighting and power system. V. Tujague, comptroller.

Montgomery, Ala.—Sealed bids are asked until April 7 for furnishing electric lights for 1, 2, 3, 4, 5 and 10 yrs. from Jan. 1, 1903. R. S. Williams, cy. treas.

The construction of electric light plants is contemplated at the following places: Greenville, Ala.; Anaconda, Mont.; Clay Centre, Neb., Ludlow, Ky.

Summit, N. J.—The contract for lighting this city was awarded to the Essex Union Lighting Company for two years at $15.70 each for twenty-five c. p. incandescent lamps and $96 for arc lamps.

Cripple Creek, Col.—Bids for the franchise for arc lights were received March 17 as follows: C. A. Powers, $5; Pike's Peak, $12.50; Wale, $10; J. P. Kerin, $10; People's Company, $12.50.

Peabody, Mass.—(Special.)—This town will expend considerable money on electric light construction, the work of completing the installation of the alternating system for the municipal lighting plant will be done.

Buffalo, N. Y.—The Cleveland Vapor Light Company, Cleveland, O., recently made a proposition to this city for street lighting, offering to install fifty hydrocarbon street lamps on any street in the city so that the city officials and taxpayers may see for themselves what an effectual and brilliant light can be secured.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Gloucester, Mass.—(Special.)—The sum of $4,000 has been appropriated for the establishment of a garbage and ashes plant.

Baltimore, Md.—The contract for removing garbage was awarded, March 8, to Samuel A. Rice, 900 Frederick-st., Baltimore, Md., for $12,230.

Logansport, Ind.—Messrs. Holloway, Giffe, Boyer and Slaybaugh have been appointed a committee to ascertain the cost of a garbage crematory.

Chicago, Ill.—Sealed bids are asked until 2 p. m. April 8 for sprinkling the streets for the U. S. Barge office for the fiscal year. William Penn Nixon, custodian.

Holyoke, Mass.—(Special.)—Bids have been advertised for the collection of garbage for the ensuing year. The board of public works has awarded a contract to the American Car Sprinkler Company of Worcester, Mass., for the use of one car from April 15 to Nov. 1 for $2,750. The city pays annually $8,000 for sprinkling the streets.

London, Ont.—Contracts for street sprinkling have been awarded as follows: Section 1, $384, and section 2, $497, John Hislop; section 3, $289.50, and section 4, $293, Thomas Morkin; section 5, $275, W. D. Gunson; section 6, $297.50, Turnbull & Co.; section 7, $305.50, and section 8, $295, Bibbings & Son; sections 9 and 10, $635, Chantler Bros.; section 11, $329.50, John Robinson.

FIRE APPARATUS.

Seattle, Wash.—The purchase of two new fire engines is contemplated by the council.

Bridgeton, N. J.—The purchase of a chemical engine is contemplated. Fire com.

Lafayette, Ind.—The purchase of an aerial truck and hose wagon has been recommended by the fire committee.

Geneva, N. Y.—The question of issuing $11,000 for the purchase of a fire engine, chemical engine, two life nets, deluge sets and 5,000 feet of hose will be voted on.

Youngstown, O.—A resolution has been introduced asking for purchase of additional fire engines. David Tod, Edward Powell and John W. Brennan, fire department committee.

Eden, Me.—A resolution has been passed directing that the chemical engine be exchanged for a four-wheel chemical engine. A fire alarm system is contemplated at Bar Harbor.

Peabody, Mass.—(Special.)—The purchase of a new steam fire engine will be recommended by the finance committee, which will advocate an appropriation of $5,000 for that purpose.

TOO LATE FOR CLASSIFICATION

Salina, Kas.—An ordinance was passed March 18 for building a lateral sewer on N. Tenth-st. Cy Engr. Hamilton.

Richmond, Mo.—Resolutions were adopted March 18 for paving the public square with macadam or vitrified brick.

Latrobe, Pa.—Sealed bids are asked until 8 p. m. April 7 for grading, curbing and paving S. Ligonier-st. Hal M. Fink, secy.

DeKalb, Ill.—The contract for constructing the intercepting sewer was awarded March 21 to C. T. Bartlett of Evanston, and for building the septic tank to Charles Mark of this city.

Sullivan, Ind.—Sealed bids are asked until 2 p. m. April 11 for asphalt paving on Thirtieth-st., from Woodland-ave. to Lydia-ave. Robt. W. Waddell, cy engr.

Jerseyville, Ill.—The contract for paving Pearl-st., from Main to Lafayette with brick, was awarded March 22 to Wolf, Curdie & Maupin of Alton at $1.55 a square yard.

Allegheny, Pa.—Sealed bids are asked until 3 p. m. April 3 for furnishing a 5,000,000 gal. pumping engine for the Howard-st. pumping station. John R. Murphy, cy. engr.

Grand Rapids, Mich. —Brick paving contracts were awarded March 21 as follows: Cherry-st., $18,347, and William-st., $5,316, James McDermott; Ottawa-st., Mathewson & Kloate, $2,470.

Allegheny, Pa.—Sealed bids are asked until 3 p. m. April 3 for the masonry and brick work for the foundations for boilers at the Montrose pumping station at Montrose. John R. Murphy, cy. recorder.

Cleveland, O.—Sealed bids are asked until April 23 for paving Cumberland-st., from Oakdale-ave. to Woodlawn Hills, with brick, and for repaving Front-st., from Water to Spring, with Medina stone or cement. Chas. Salen, dir. P. W.

Dayton, O.—Sealed bids are asked until April 22 for constructing the Northwestern storm sewer, consisting of 2,360 feet of 5, 4, 3 feet brick or concrete sewer, 2,130 feet of 30, 24, 18, 12-inch pipe sewer; 14 manholes, 2 catch basins. G. F. Kuhns, pres. bd. cy affairs.

New Glarus, Wis.—Sealed bids are asked until 2:30 p. m. April 4 for laying water mains, setting hydrants, valves and other accessories of the pipe line, and for the construction of a concrete reservoir. S. A. Schindler, pres. vil. bd; Jacob Fige, vil. clk.; W. G. Kirchoffer, engr.

Gloucester, Mass.—(Special.)—One of the most important measures adopted this year is the resolution order calling for a survey of the city on the same plan in vogue in New Bedford and other cities, by means of which it is hoped to increase the valuation from the present figures, a little short of $16,000,000, to $20,000,000 and perhaps more. This work will probably entail an outlay of $30,000, but $10,000 is only allowed for it the present year. It will be carried out either under the direction of the city engineer or by contract, whichever the revaluation committee may elect to recommend.

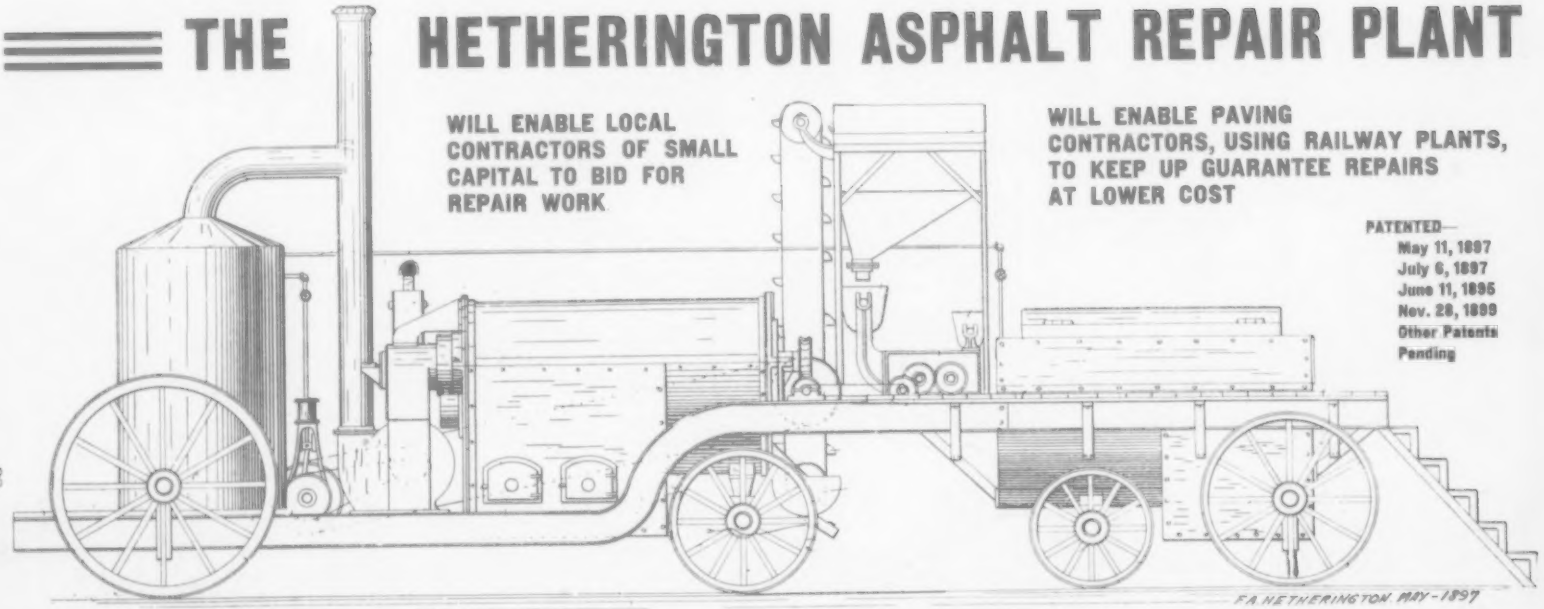
Fitchburg, Mass.—(Special.)—The most important municipal work in sight is the remodeling of the sewerage system, which will do away with the present single pipe service for house waste and storm water, now emptying into the north branch of the Nashua river. The work will involve the building of a trunk sewer through the city, delivering the waste below the city, where it will be purified by sand filtration and the effluent discharged into the river. The legislature has already authorized a special loan of $500,000 bonds outside the debt limit, to be used when needed. Paving work this year will be only granite block paving in pitch and sand joints, and not large in amount, the general policy being to do some each year where radical need of re- will be done by the local street railway in connection with the double tracking of parts of its route. This will cost the city pairs is apparent. A considerable amount nothing.

THE HETHERINGTON ASPHALT REPAIR PLANT

WILL ENABLE LOCAL CONTRACTORS OF SMALL CAPITAL TO BID FOR REPAIR WORK

WILL ENABLE PAVING CONTRACTORS, USING RAILWAY PLANTS, TO KEEP UP GUARANTEE REPAIRS AT LOWER COST

PATENTED—
May 11, 1897
July 6, 1897
June 11, 1895
Nov. 28, 1899
Other Patents Pending



As the railway asphalt plant has now come into general use and its efficiency so increased that in point of capacity it is the equal of most permanent plants, many very large paving contracts have been executed by its means. Its general use has at the same time made apparent the necessity of a portable plant of small capacity which can be shipped from place to place upon an ordinary flat car, and which can be operated, for the purposes of repairs, by four or five men. To ship a regulation railway plant from one city to another is a matter attended with some expense and loss of valuable time, and often the amount of repair work is inconsiderable. In order to fill the need of operators, in this respect, the above illustrated repair plant was designed by F. A. Hetherington in the early part of 1899, and a patent therefor was issued in November of 1899.

Owing to the press of other business however, no plant of this description was constructed. At the present time the Hetherington & Berner Company are actively engaged in the practical development of the idea, and in the course of sixty days expect to have such an apparatus ready for the trade. They design to manufacture these plants in two sizes; one of a capacity equal to about 250 square yards of two-inch topping per day, and another and larger which will have a capacity of about 750 yards per day. It is expected that the plant can be put upon the market at such a reasonable price that any operator of large railway plants will find it economy to own one. When the company is ready to book orders for these plants, the public will be notified through the pages of this magazine.

HETHERINGTON & BERNER, INDIANAPOLIS, IND., U. S. A.